Compressed Air Magazine

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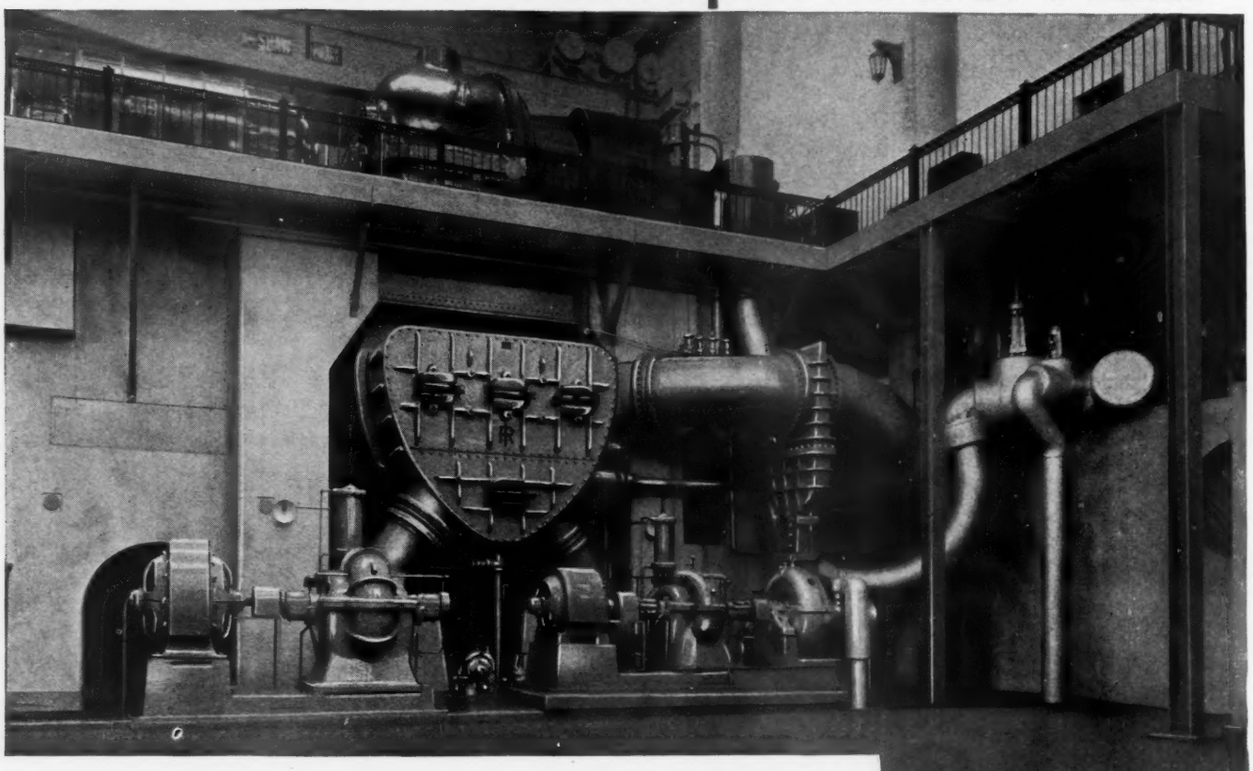
CHIPPING BILLETS IN A STEEL MILL

The Third I-R Condenser Serving The Pasadena Municipal Power Plant



INGERSOLL-RAND points with justifiable pride to the third condenser installation for the Municipal Power and Light Department in Pasadena, California. The first of these condensers serves a 10,000, the second a 15,000, and the third a 25,000 kw. turbo-generator unit—a total of 50,000 kw. These successive installations represent another tribute to I-R ability to meet and overcome condenser problems in power plants.

Each of the three condensers in this plant is served by I-R auxiliary equipment throughout—circulating and condensate pumps, and steam-jet air ejectors. The two circulating pumps for each unit are of unequal capacity (one large and one small) to provide a wider range of water quantities. During periods of light-load-operation, satisfactory vacuums are obtained with the small pump operating alone, thus effecting a material saving in pump power.

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C. H. VIVIAN
Editor

A. M. HOFFMANN
Assistant Editor

European Correspondent
LINWOOD H. GEYER
144 Leadenhall Street
LONDON, E. C. 4

Canadian Correspondent
F. A. McLEAN
620 Cathcart Street
MONTREAL

Business, Editorial and Publication Offices
PHILLIPSBURG, N. J.

Advertising Office
11 Broadway
NEW YORK CITY

EDITORIAL CONTENTS

Making Fine Silverware—C. H. Vivian 4891
Moving a Concrete Highway with Air—Allen S. Park 4897
Glimpses of Large Construction Jobs 4902
Thirty Years of Canadian Mining, Northwestern Quebec, Part II—R. C. Rowe 4905
Providence Men Seek Sunken Treasure 4912
Air Motor Moves Portable Gravel Plant 4913
Editorials—The Caprices of Research—Where Stout Hearts Reign—A New Use of Compressed Air 4914
Industrial Notes 4915
Self-Contained Work Train 4915
Plant Uses Colloidal Fuel 4915

ADVERTISING INDEX

Allis Chalmers Manufacturing Company ..... Inside Back Cover
Austin-Western Road Machinery Co., The 8
Bucyrus-Erie Company 11
Combustion Engineering Co., Inc 3
Compressed Air Magazine Co. 22
Direct Separator Co., Inc., The 22
General Electric Company 19
Goodrich Company, The B. F. 10
Hercules Powder Company, Inc. 16
Ingersoll-Rand Company 6-9-12-15-18-21
Jarecki Manufacturing Co. 24
New Jersey Meter Co. 24
Norton Company 7
Owens-Illinois Glass Company 13
Texas Company, The 4-5
Timken Roller Bearing Co., The ..... Back Cover
Torrington Mfg. Co., Inc., The 24
Vogt Machine Co., Inc., Henry 14
Waukesha Motor Co. 20
Westinghouse Electric & Mfg. Co. 17

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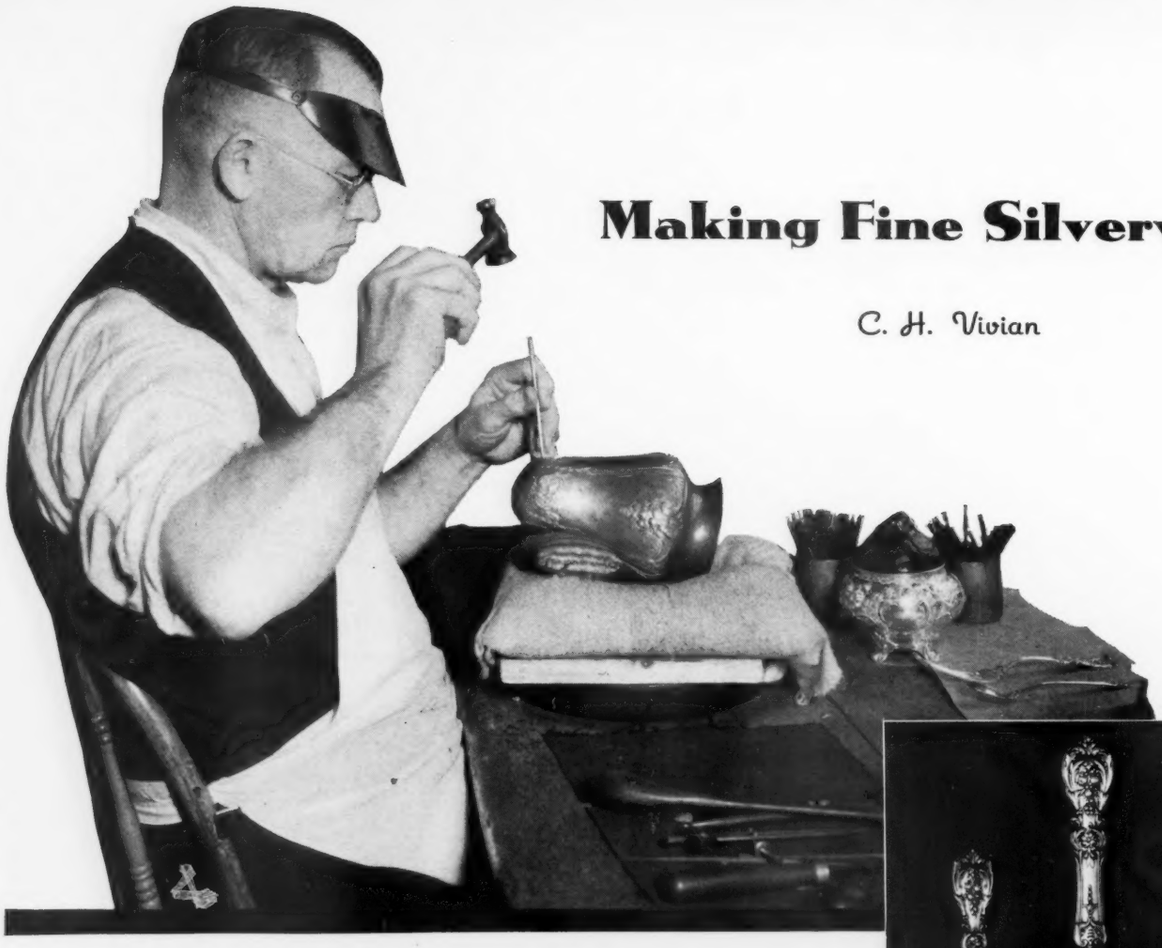
Making Fine Silverware

C. H. Vivian



WORK OF CHASING

Two of the principal methods used to produce fine decorative effects are chasing and engraving. Both call for artistic skill and close application. The chaser shown above employs essentially the same technique as did the master silversmiths of the Middle Ages. While being worked upon, the piece is filled with a plastic material to keep it in shape and rests upon cushions to prevent marring its surface. The myriads of small tools that are used are shown on the bench. Alongside of them is a piece of finished silverware with its filling still in place.

A POPULAR PATTERN

This Francis I design, wrought in sterling silver, is an exquisite example of the die-maker's art. The demand for this pattern has increased steadily since its introduction a number of years ago, and it is considered by Reed & Barton as its leader.

KNIVES, forks, and spoons are such commonplace articles nowadays that it is difficult to realize that they were, comparatively speaking, rarely used until three or four centuries ago. It is nevertheless true that in the Middle Ages few households could afford more than a meager supply of these eating utensils, and guests were expected to bring their own. Of the three, it seems certain that the spoon was first employed, probably because seashells could be readily adapted for the purpose. Spoons were next fashioned of wood, slate, or ivory, and examples of all of these different kinds have been excavated from Egyptian tombs known to be more than 4,000 years old.

Knives were used for hunting and as weapons long before they became adjuncts to eating. Even after they were introduced into the household, their primary purpose was for dressing game and for cutting meat prior to serving it rather than to be of aid in the actual consumption of food. After that the knife was alike a man's eating utensil and his weapon; and during the later Medieval period, persons who were not entitled to carry firearms wore a knife in a belt scabbard under the guise of an accessory to eating.

The fork, too, was at first regarded essentially as a weapon. It was probably employed to hold meat over a fire for cooking long before it graced the table. Its use as we now know it did not become general until the sixteenth century. The common people thought it effeminate to raise food to the mouth with a fork, and did not take to the custom until after the nobility had accepted it. Because it was a substitute for God-given fingers, the English clergy condemned its use, but eventually the fork's utility won it a permanent place at the table over all protests. The first forks had only two prongs, a third, and then a fourth, being added later.

As mankind learned to work metals, these materials were adopted for the making of eating utensils. Ornamentation of the handles began to be the vogue, and thus was conceived our modern flatware industry. During the Tudor and Stuart reigns in Great Britain, a treasured gift at a christening was an Apostle Spoon, so called because its handle bore the figure of one of the Apostles. A complete set of twelve such spoons was highly valued. Sometimes there was added a thirteenth spoon, known as the Master Spoon, be-

cause its handle was decorated with a representation of Christ.

Although persons in ordinary circumstances were fortunate to possess eating utensils of any sort, those of higher rank often had costly collections of elaborately fashioned tableware. Silver quickly became the favored metal for this purpose, not only because of its intrinsic value but also because of its beauty and its workability. During the Renaissance, goldsmiths and silversmiths, who worked under the patronage of nobility and royalty, achieved triumphs of art that will live through the ages, although many of their finest pieces have unfortunately long since been melted down to recover the metal they contained.

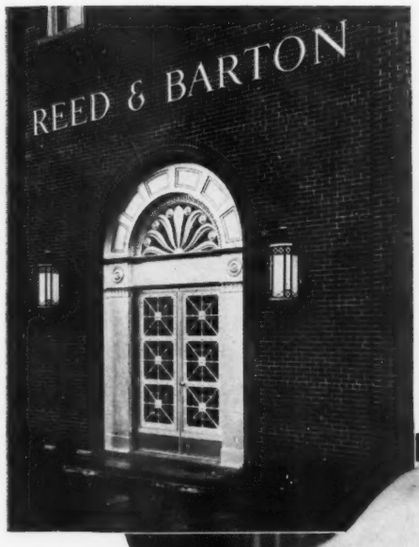
From this start, the European nations gradually built up tableware industries; and each one of the designs and patterns was given an individuality that rendered the products easily recognizable as to origin. With the migration from the Old World to the New, these distinctive characteristics were transplanted to the several sections where the different nations established settlements. Consequently, early colonial silverware reflected the traditions of the British, Dutch, French, or Spanish artisans, according to whether it was made in New England, New York, Louisiana, or Florida. With the subsequent intermingling of the various nationalities these distinguishing features became less pronounced, and finally disappeared. The infant American silverware industry continued in healthy growth, however, and its better-grade articles now compare favorably in beauty of design and excellence of workmanship with those of any other country.

Much of America's finest silver tableware is made by Reed & Barton in Taunton, Mass. Aside from the high quality of its products, this firm has several claims to distinction. For one thing, it has been in business 111 years and, like the shoemaker, has stuck to its last. Its founder, Henry G. Reed, began making pewterware in 1824. Silver plate was added to the line in 1849, and sterling silver in 1889. At present all three are made, although pewter comprises but a small part of the whole and is retained largely for sentimental reasons.

Throughout its long existence the firm has remained in the control of one family, and has had only three presidents. Mr. Reed served as president for 75 years. He was succeeded by his son-in-law, William B. H. Dowse, who held the position for 25 years. He, in turn, was followed by his son-in-law, Sinclair Weeks, the incumbent, whose father was Secretary of War in President Harding's cabinet.

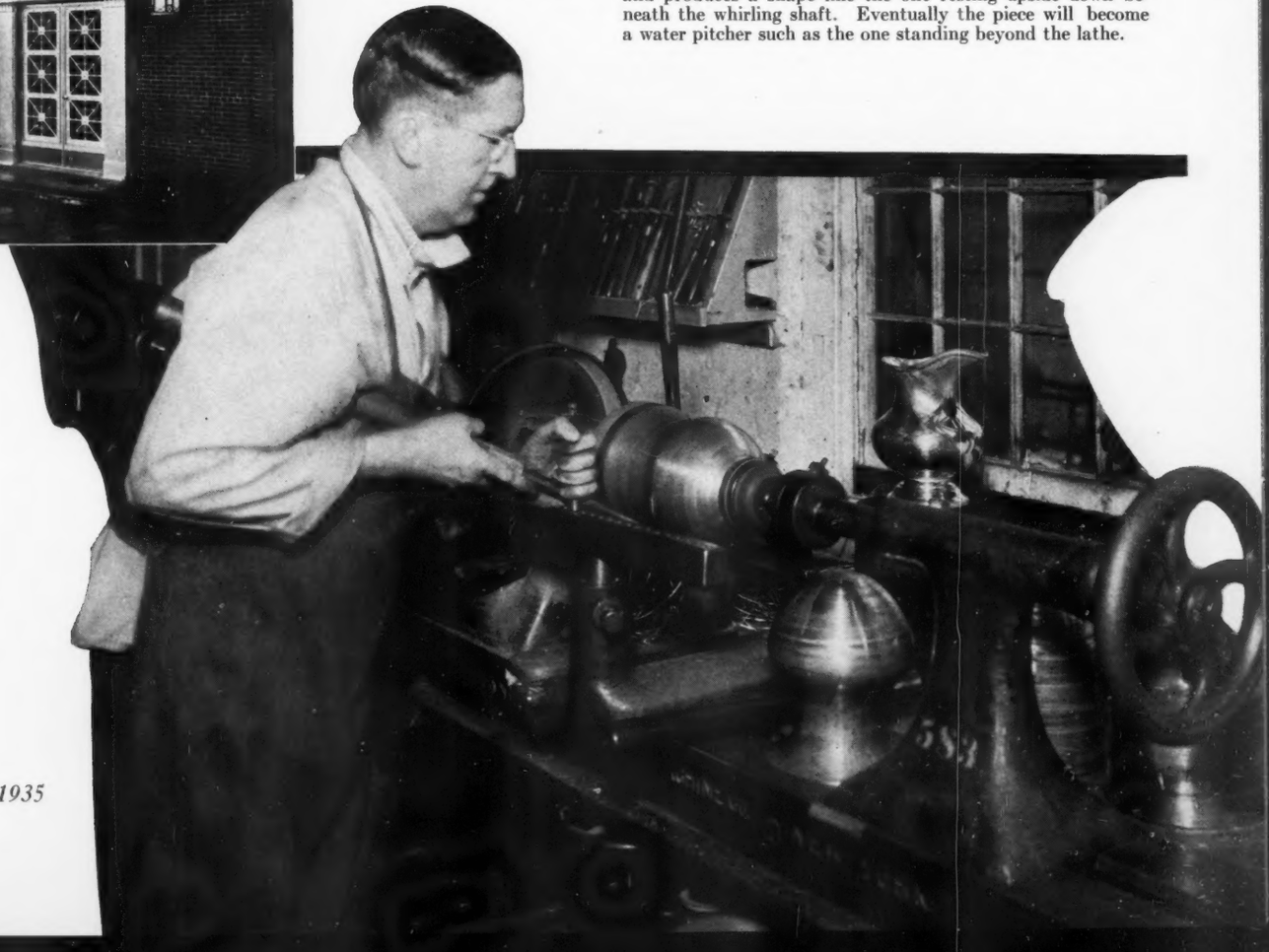
Reed & Barton has always been located in Taunton and has grown progressively from a 3- or 4-man shop to a plant that now covers fourteen acres. Some of the employees represent the fourth generation of families that have worked for the firm, and there are many instances of third-generation workers. There are workmen who have been with the concern more than 60 years. They stay because they want to, for they may avail themselves of a generous retirement plan at any time they care to. Their reluctance to quit has caused the management no little concern in recent years. when the policy has been to give preference in employment to the younger men with dependents. One old lady remained a daily caller until past 90. A special room, with all the comforts of home, was fitted up for her, and a company automobile transported her to and from the factory each day. The current payroll numbers about 650: at the height of the post-war prosperity it reached 900. Incidentally, this firm was one of the first in New England to employ women. The

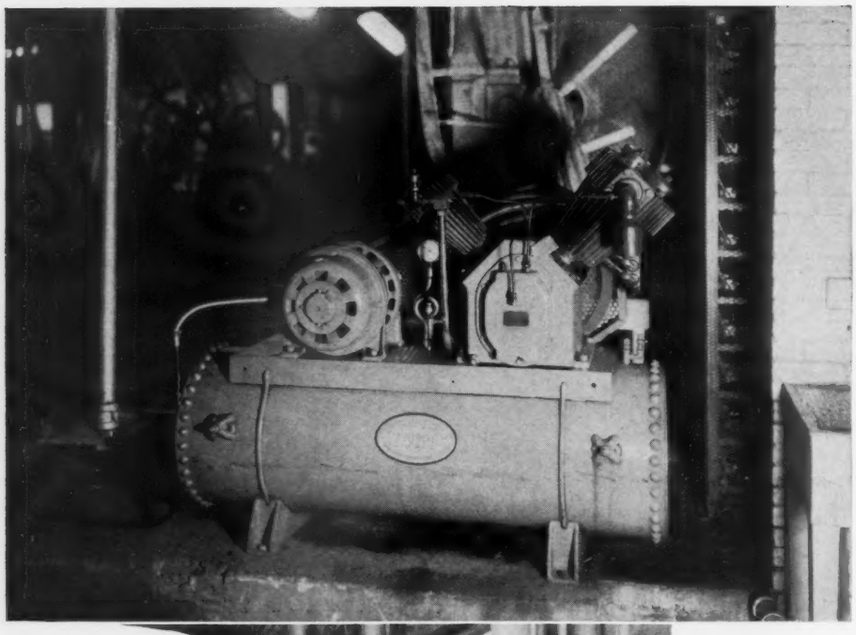
MAIN ENTRANCE TO THE REED & BARTON FACTORY

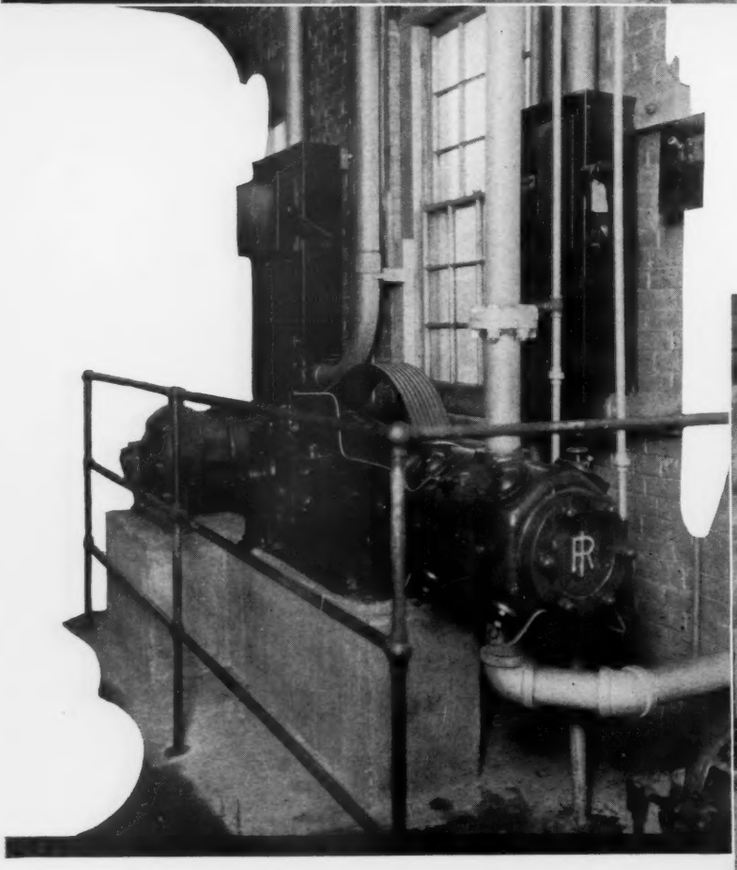


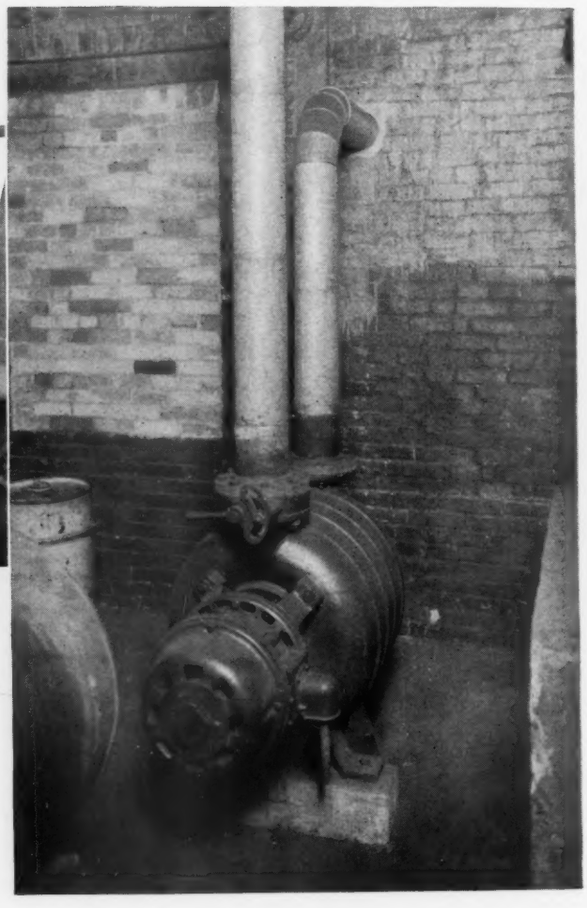
SPINNING

While a plain piece of hollow ware is rotating rapidly in a lathe, being supported the while at its hollow end by a collapsible wood form, the workman shapes it by exerting pressure against its outer surface with a steel tool which he braces against a metal support. He starts with forms such as those shown back of the wheel at the right, and produces a shape like the one resting upside down beneath the whirling shaft. Eventually the piece will become a water pitcher such as the one standing beyond the lathe.









COMPRESSED-AIR SUPPLY

High-pressure air for operating drop hammers and for other purposes is supplied by three Ingersoll-Rand compressors. Two of these are of the single-stage, straight-line, horizontal type. One of them is shown just above. They discharge into a common receiver of sufficient capacity to provide a large volume of air for instant use. The third compressor (top) is a 2-stage, air-cooled unit mounted on its receiver. Low-pressure air for firing oil furnaces, torches, etc., is furnished by the "Motorblower" at the right. It has a capacity of 600 cfm. at a discharge pressure of 1½ pounds.

initial female workers were assigned the task of polishing newly made silverware by rubbing it with the palms of their hands. This method of polishing imparts a finish that is difficult to attain in any other way. It was practiced by the butlers in well-to-do English households, and hence was called the butler finish, a term which is still used in the silverware trade.

The foregoing rather personal facts indicate that the business has its fascinations, and that Reed & Barton is steeped in fine old traditions. It takes justifiable pride in its background, and even more in the quality of its products. From what has been written it can also be readily construed that, despite the mechanization that has crept into all industries, the making of fine silverware is still largely a handicraft. Some routine jobs are accomplished by the joint action of hands and machines, while certain decorative effects such as engraving and chasing are obtained solely by craftsmen and in almost the same painstaking way by which Cellini and other master silversmiths achieved them during the Middle Ages. The average housewife probably has little idea of the amount of work involved in producing such a simple-appearing object as a plated teaspoon. Actually, in the Reed & Barton plant, 37 separate and distinct operations are performed in the course of its manufacture.

As would naturally be inferred, the de-

mand in recent years has run more to plated ware than to sterling. During the era of fabulous salaries in the motion-picture industry, Reed & Barton not infrequently received orders from screen luminaries for specially designed sets of sterling, but even Hollywood purse strings have now been drawn a little tighter. Much sterling is still sold, however, particularly for gift purposes.

The largest single order for sterling ware ever placed with the firm was given by the Maharajah of Barwani, India, about twenty years ago. The Maharajah, while on a visit to Paris, asked five of the world's leading silversmiths to submit designs of tableware and to send representatives to confer with him. He then chose the American product. Aside from its size—it included such quantities as six dozen meat platters and ten dozen goblets—this purchase had other points of interest. As the Maharajah lives in remote Central India, the silverware had to be packed in a sectional case that could be dismantled to facilitate transportation inland. After a train haul of 600 miles, the silver was moved 200 miles in canoes, then carried an additional 200 miles on the backs of native burden bearers. The Indian potentate fancied the set so much that he subsequently ordered, through Reed & Barton, a duplicate in aluminum ware that he could take with him on hunting expeditions.

STAMPING SILVERWARE

All flatware is formed by striking blanks in dies. Some hollow ware is shaped similarly, and ordinary decorative effects on both classes of ware are imparted in the same manner. Flatware is formed by five pneumatic hammers, three of 900 pounds capacity and two of 600 pounds capacity. By varying the distance that the hammer falls, the force of the blow can be regulated to meet the requirements of each piece. Four of these hammers are shown at the top, and at the left is a close view of one of them. Hand-operated "pull" hammers, up to 1,800 pounds in capacity, are used for shaping hollow ware. One of them is seen above. At the left of the operator are pieces which have been formed by striking a flat disk of metal such as that shown on the right side of the hammer.

New patterns are continually being introduced to meet the public demand for something different, but comparatively few of these attain lasting favor. The current trend is towards modernistic designs. In general, according to Reed & Barton officials, New England people prefer simpler patterns than does the rest of the country. The West likes the ornate.

The most popular Reed & Barton pattern in sterling silver is the Francis I, named for the sixteenth century French monarch who had a penchant for fine silverware. Introduced some 25 years ago, its sale has increased each year since. It is doubtful, say Reed & Barton executives, if die work of the character it requires could be turned out at present, as modern youths who take up die-cutting are unwilling to serve the long apprenticeship that is necessary to attain the degree of expertness that was the rule when the intricate Francis I design was conceived. New patterns are first drawn by staff artists, then passed upon by a committee which determines whether they shall be adopted. The concern maintains dies for 213 patterns, of which 138 are made in sterling and 75 in plate.

While every housewife naturally prefers sterling-silver tableware, probably few realize that the exterior of plated ware is actually purer silver than sterling. The alloy known as sterling silver is composed of 925 parts silver and of 75 parts copper, whereas plating silver is absolutely pure. A fact of incidental interest learned while visiting the Reed & Barton plant relates to the derivation of the word "sterling."

During the twelfth century, England carried on considerable trade with the races of eastern Europe, who were known as "Easterlings." The silver coins which were received in payment for goods were called "Sterlings," to distinguish them from the people. It came to the notice of the English that these coins were brighter than their own. Upon investigation they found that they were of the composition just mentioned. Silver of that fineness subsequently was designated as sterling; and the word now denotes a standard that is recognized everywhere. Americans were very lax about enforcing it, however, and it was formerly the practice of silversmiths to stamp "sterling" upon any alloy that contained half or more of silver. Finally, in 1886, these craftsmen apparently found their conscience and asked Congress to pass a law fixing the composition of sterling, which was done. The Government now permits a deviation of only 3 parts in 1,000 from the specified silver content. If this tolerance is exceeded, the ware cannot be legally marked as sterling.

The base for most plated ware is an alloy of nickel, copper, and zinc, or one of tin, antimony, and copper. For the harder service in public eating places, tableware requires a more resistant metal, and one with a nickel content of 18 per cent is generally used. Hotelware, as it is known, forms a very important part of Reed & Barton's business, as its silver is in use either in whole or in part on about 90 per cent of the nation's dining cars, on many ships plying American waters, and in numerous hotels. Well-made plated wear will retain its good appearance for from 20 to 25 years in ordinary household service.

Silverware is divided into two classes: flatware and hollow ware. The former —knives, forks, and spoons—will be chiefly mentioned in the remainder of this article. The raw material for flatware, whether base metal for plated articles, or sterling silver, reaches the manufacturing floor in the form of strips of the requisite widths and thicknesses for the desired products. The first operation is the blanking out of pieces for subsequent shaping. Blanks for forks and spoons approximate the general forms of the finished articles, but those for knives ordinarily do not, because in these days of stainless-steel blades only the handles are usually made of nonferrous metal. Knife handles are hollow partly to reduce weight, and are fashioned by soldering together two half-shapes.

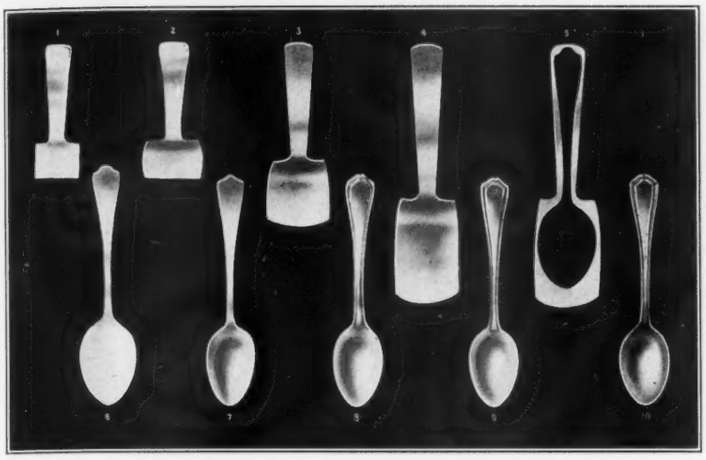
Blanks for spoons are rolled crosswise to widen them and are then "graded" by passing them lengthwise through eccentric rolls. The latter serve to vary the thickness of different portions, leaving ample metal at the neck, where strength is needed, and reducing the gauge of the central part of the section that will eventually become the bowl. Grading is essential to the shaping of the handle—to giving it its correct proportions, and also greatly facilitates forming it subsequently. In the case of forks, the metal strips undergo the respective rolling operations before the blanks are stamped out.

The actual shaping of the blanks is done by die-stamping. Designs are impressed upon them in the same manner, but in a separate and later operation. Machines traditionally used for these purposes are known as belt or drop hammers, so named because the weight which delivers the forming blow is raised to the top of its stroke by means of a belt. The latter passes over a revolving pulley on overhead shafting, and its loose end, to which a handle is attached, hangs within convenient reach of the operator. A pull upon the belt end tightens it around the pulley, and the resulting friction suffices to lift the weight with a small expenditure of human energy. As it nears the top of its stroke, the weight throws a trip which prevents it from falling until the operator releases it.

In the Reed & Barton plant hollow ware is still shaped by means of such equipment; but modern pneumatic drop hammers are used in forming flatware, there being five such machines in service. These hammers, particularly the newer models, are of such interest as to warrant a brief description. They are made by the Pneumatic Drop Hammer Company of Boston, Mass., and are widely employed for stamping metals. In the past, the use of power hammers or presses has been attended by objectionable building vibration, especially when the in-

THE SILVER-PLATE ROOM

A similar display of sterling silver is maintained at the Reed & Barton plant for the convenience of prospective customers. Most of the ware is marketed through the channels of the jewelry trade.



EVOLUTION OF A SILVER SPOON

The blank (1) is cut from a strip of sterling silver. It is widened (2) by cross rolling. It is then rolled lengthwise (3). Next comes the grading, during which eccentric rolls further lengthen it and give different sections of it varying thicknesses (4). A flat, spoon form (6) is then punched from the blank (5). This piece is die stamped to shape it (7). It is struck once more in a die to impress the pattern (8), excess metal being extruded at the sides. This is trimmed off (9); and after cleaning, grinding, and polishing, the spoon is finished (10).

stallations were above the ground floor. To alleviate this condition, it has been customary to mount hammers on posts extending to the ground, or on spring-supported bases, to absorb the shock. Either method was expensive and wasteful of valuable space. By means of an ingenious design based upon a simple principle of physics, the Pneumatic Drop Hammer Company has devised a hammer that not only completely does away with vibration and shock but also makes sure that virtually the full force of the blow will do useful work and will not be partially dissipated—taken up by the supporting structure.

The design rests upon the fundamental law expressed by Kent that "if two inelastic bodies of equal momenta impinge directly one upon another from opposite directions, they will be brought to rest." Instead of the lower member, or anvil, being stationary, it moves upward to meet the falling hammer. Its weight and rate of motion are so coördinated that it will develop in a short distance of travel an amount of energy equal to that developed by the heavier hammer, falling through a considerably greater distance, at the instant of impact. As a result, the two opposing forces are spent in work without loss of energy, and both members are brought to rest without setting up vibration. A hammer of this type weighs approximately one-quarter as much as a conventional drop hammer of corresponding capacity. Upward movements of the hammer and anvil are effected by compressed air: downward movements by gravity.

In the Reed & Barton plant it has been found that the work of the pneumatic hammers is superior to that of the older types, and that the accident hazard is less. An outstanding advantage is the freedom from the damaging or undesirable effects of falling dirt or dust, which is inescapable where there is overhead shafting. At the present time, the replacement of more of the older hammers with the pneumatic type is being considered.

Practically all flatware is worked cold. When the pattern is such that the finished surface shows considerable variation in elevation or relief, the forming operation is assisted materially by somewhat detailed grading, the eccentric rolls being shaped so that a greater thickness of metal will be left in local spots which are to be raised after the piece has been struck by the dies. Accurate grading likewise reduces the surplus metal or "flash" which is pressed out at the sides of the dies. This excess is trimmed off and the edges ground smooth during the finishing operations. The striking of silver in a die renders the metal hard, and to restore it to workable softness it is annealed accordingly after being shaped and before the design is impressed. This is done by passing it through small gas-fired annealing furnaces from which oxygen is excluded to prevent oxidation. It is essential to the success of the die work that the pieces be free from dirt, grease, etc., and to this end they undergo washing between the successive manufacturing steps. In exceptional cases, where the design is extremely intricate, silver is hot-forged.

Compressed air at 105 pounds pressure is used to operate the hammers. Four of the units are served by an Ingersoll-Rand Class ER-1 machine and a Class ES-1, each of 107 cfm. piston displacement and driven through Texropes by a 15-hp. motor. Both discharge into one receiver. The fifth hammer obtains air from an Ingersoll-Rand Type 30 air-cooled compressor of 31 cfm. piston displacement. It is driven by a 7½-hp. motor. Low-pressure air for the oil-fired furnaces in the plant is furnished by an Ingersoll-Rand Type M "Motorblower" which is driven at 3,500 rpm. by a General Electric 10-hp. motor. It discharges at 1½ pounds pressure, and delivers 600 cfm.

Following the forming and grinding operations, the pieces are cleaned with pumice and oil. Expert workmen hold them against revolving wheels, faced with walrus hide or brushes, with just enough pressure to remove adhering dirt and rough spots without marring the pattern, feeding the cleaning mixture at the same time. The articles are next washed with soap and water and various cleaning solutions. Sterling silver is then ready for the market except for buffing, but ware which is to be plated must receive its silver coating. This is done by the electroplating process, the ware being immersed in a bath of silver solution. In the electrical circuit that is set up, bars of pure silver form the anode and the articles constitute the cathode. During the transfer of the metal, the composition of the silver solution or electrolyte remains unchanged.

The plating of flatware to the desired thickness requires about 20 minutes. Parts of pieces that are subjected to heavy wear, such as the bottoms of spoons, are subsequently given an additional coating of silver by suspending those parts in the electroplating solution. Following the plating, the ware is washed and is then buffed or not, depending upon whether it is to have a bright or a dull patina finish.

In the case of knives which are fitted with stainless-steel blades, there are some intermediate steps in the procedure already described. The half-handles are temporarily held together by electric spot welding at two points on either edge. Powdered-silver solder and flux are then inserted in the open end of the hollow shell and distributed around the edges by turning and shaking. The handles next go into a furnace. When the solder melts, it is carried around the seam between the abutting edges by capillary attraction and welds the halves firmly together. To prevent marring the ouside surface of the handle, it is given an application of whiting before being placed in the furnace. This is later removed, as well as any adhering solder.

The handles and blades, the latter being purchased, are now ready for assembly. The blade end, in the form of a rod known as the tang, is inserted into the handle, in which it fits snugly. Next solder is applied, and the pieces are put in a machine that quickly solders the parts together by electrical resistance. This procedure, as compared with the former practice of using pitch, has much in its favor. As every grandmother knows, the pitch sometimes melted when the knives were placed in boiling water, and the blade and handle parted company.

GENERAL VIEW OF OPERATIONS

This picture was taken during the moving of a strip of pavement 455 feet long and consisting of thirteen slabs each 14½x35 feet. It shows details of the apparatus developed to facilitate blocking-up behind the air hose after each move.

Moving a Concrete Highway with Air

Novel Method is Successfully Shifting 400 Tons of Concrete Slabs at a Time

Allen S. Park

THE expansive force that air exerts when it is compressed is being utilized by the New Jersey State Highway Department to move an 8-mile strip of concrete highway a lateral distance of 12 feet. The method is ingenious, but extremely simple. Jacks and similar mechanical contrivances actuated by compressed air have been used for shifting loads, but, so far as is known, this is the first time that expanding air has been directly applied to such a task. To engineers who have watched the operation it has suggested the possibility of using similar methods for raising buildings and other structures in preference to the mechanical equipment now employed for these purposes.

Disregarding details for the moment, we may say that the change in position is effected merely by inserting a hose in a narrow space next to the strip of concrete to be moved and by inflating the hose with air. As the pressure mounts and the hose expands, the concrete is pushed over slowly, steadily, and evenly. By blocking off part of the space thus cleared and repeating the process, the strip of roadway is progressively shoved over until it has been shifted the desired distance of 12 feet. No rollers or other friction reducers are employed. The concrete slab simply slides over the ground surface. The area it is to occupy is, of course, graded to the correct elevation in advance.

The work mentioned is taking place near New Brunswick on New Jersey Highway No. 26. It is known as the New Brunswick Pike, and is a part of the main motor thoroughfare between New York City and Philadelphia. As it now stands, it provides four travel lanes—two for cars moving in each direction. There is no physical division between the lanes assigned to opposing traffic—a lengthwise white line in the center serving as a guide.

Because of the frequency of accidents, particularly along the rural sections of the highway, it was decided to separate the lanes for north-bound and south-bound traffic by a 12-foot space. As the concrete has been laid in three strips, with intervening expansion joints, the possibility of moving one of them the required distance and then adding new concrete along its outer edge so as to make it conform in width to the other lane immediately suggested itself. The engineers then proceeded to study ways and means of bringing about this movement, and by actual experiments in the field determined that compressed air would do the work not only most satisfactorily but also economically. The pneumatic method as devised and developed by Sigvald Johannesson, designing engineer for the New Jersey State Highway Department, was therefore adopted. Mr. Johannesson's account of how this came about is interesting.

"It was originally intended to use mechanical jacks," he explains, "but in order to do this it was necessary first to open up the ½-inch-wide expansion joint a sufficient distance to admit them. In the course of our investigation of various ways of doing this we employed a hose—flattening it for insertion into the crack and then filling it with water under pressure. This worked all right so far as moving the concrete was concerned; but it had one disadvantage, that of having to dispose of the water. It was because of this that we tried compressed air. It

acted so well that the question at once arose: Why not use air for the entire movement? Further experimentation showed that this could be done; and it was decided to do it, but not until after a careful analysis of the probable costs proved to be in favor of the pneumatic method."

From the start of regular operations the system functioned smoothly, and the results obtained have fully met all expectations. Approximately 500 feet of pavement is being moved each working day, and it is believed that this average will be increased as operations become better organized.

The concrete strip being shifted is 14½ feet wide and has transverse expansion joints at intervals of about 35 feet. The established procedure calls for the moving of from 12 to 14 of these slabs at a time, or a total length of from 420 to 490 feet. The concrete is 9 inches thick and reinforced. As each slab weighs about 30 tons, the aggregate load is in the neighborhood of 400 tons.

The accompanying pictures illustrate the principal steps in the operation and also show the equipment that is being used. First of all, the section to be shoved to one side is cut from the main strip with "Jackhamers" and paving breakers. Then the bituminous filler, which is customarily placed in expansion joints to prevent the entrance of water, must be removed from the longitudinal joint. This is done quickly by means of a plowlike implement that is drawn by a regulation road roller. Workmen with narrow picks follow this equipment and dig out any remaining material.

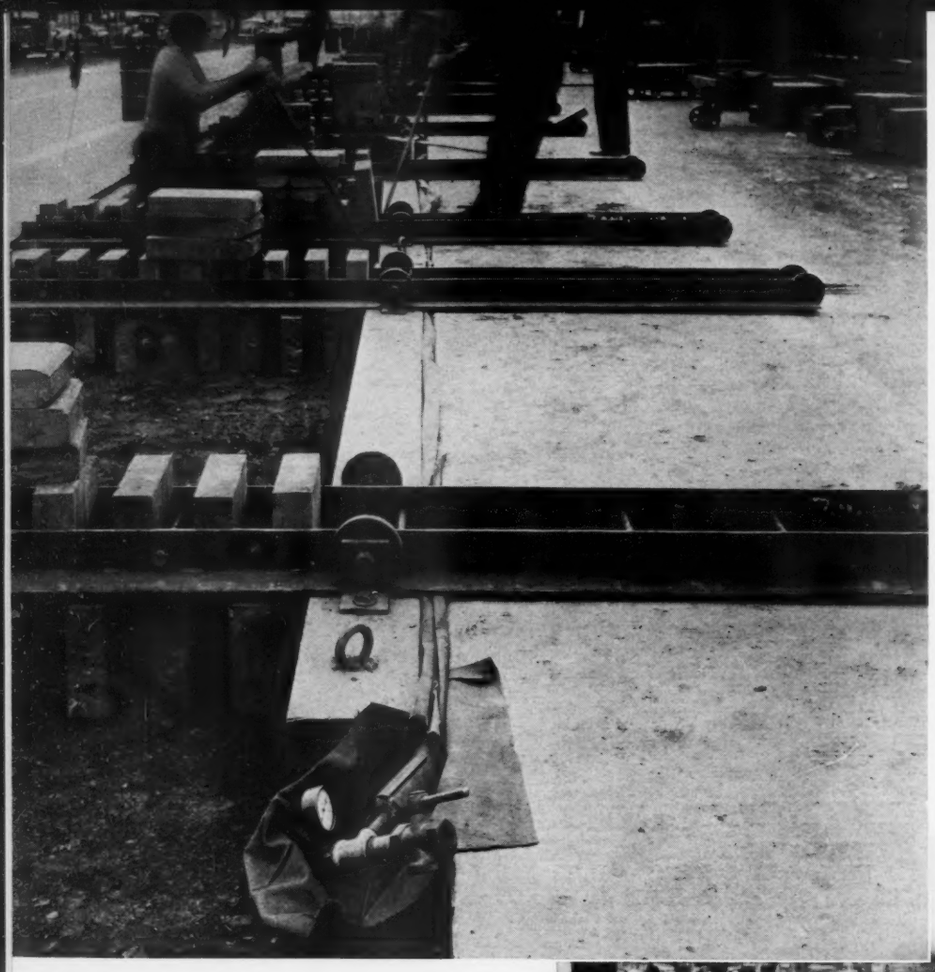
Into the ½-inch crack thus made is inserted a flattened, 3-inch-diameter, linen fire hose which, in its collapsed condition, is about 3/16 inch thick. When this is inflated, the 14½-foot-wide section of concrete, being lighter than the two abutting strips, is pushed over. The resultant initial opening is about 2 inches wide. From that point on a 6-inch, rubber-lined hose is used. When it is placed in the gap and inflated the concrete is moved an additional 3 inches, increasing the opening to about 5 inches. The air is then exhausted from the hose and a line of 3-inch planks inserted between it and the face of the 2-lane concrete strip which serves as a backing. Reinflation of the hose widens the aperture 3 more inches—that is, to approximately 8 inches. This procedure is repeated two more times, enlarging the gap to about 15 inches and permitting the introduction of special equipment, which is employed from then on.

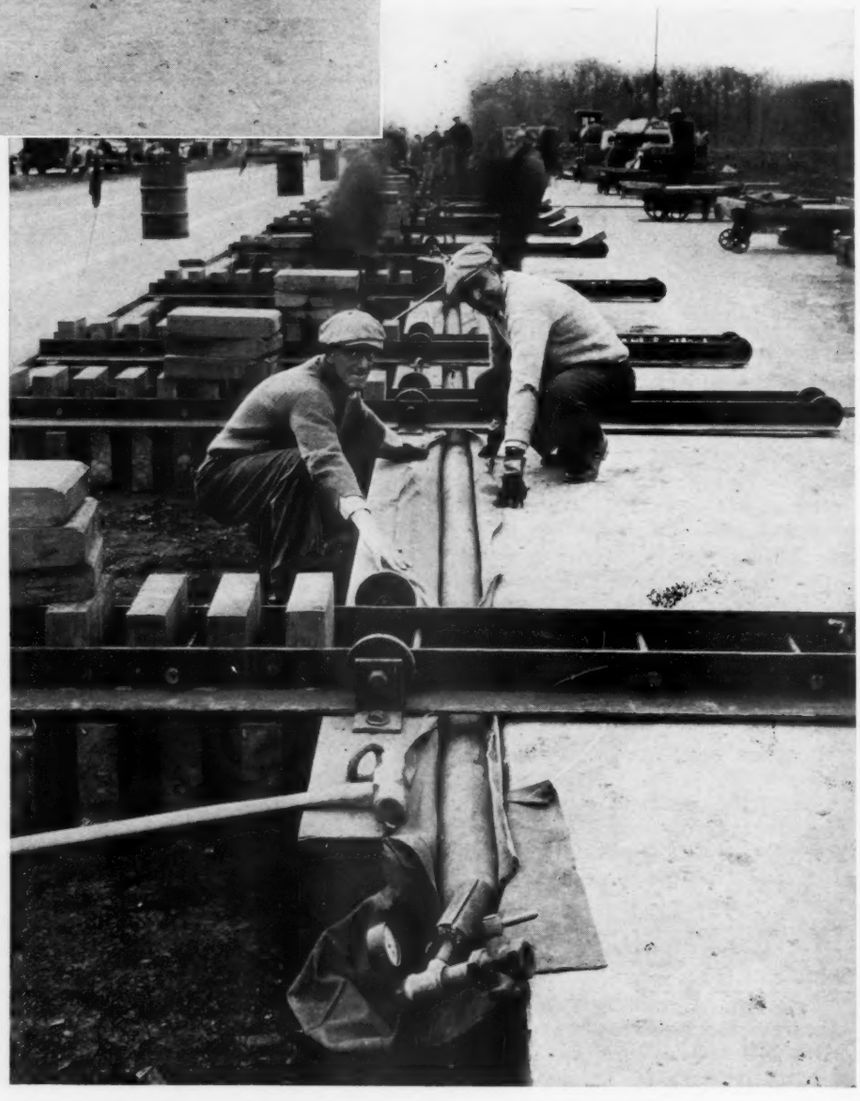
The special equipment, which is designed to hold a line of 10x10-inch timbers close to the face of the section being moved, simplifies the work that must be done between shoves by obviating the handling of heavy planking for backing-up purposes. It consists of a number of ladderlike structural-steel pieces which span the continually widening breach between the concrete strips. Each of these pieces is made up of two angle irons, 13 feet long, which are spaced a little more than 10 inches apart and tied together with crossbolts. The end which rests on the section being shifted is fitted with rollers to reduce friction as the concrete slides beneath it. Similar rollers are bolted to the 10x10 timbers, and these bear on the flat-resting flanges of the two angle irons.

By examining some of the accompanying illustrations, it can be seen that it is possible with this apparatus quickly and easily to insert additional backing after each move.

THE FIRST STEP

After the bituminous filling has been removed from the longitudinal expansion joint, a 3-inch linen fire hose is inserted in the crack, being rolled as shown to flatten it. By inflating this hose, the right-hand strip of pavement is pushed over until the opening is 2 inches wide. Subsequent moves are then made by successively inflating and deflating a 6-inch hose.





MAKING A MOVE

In the view above, the deflated hose is seen in the gap between the concrete strip and one of the 10x10-inch backing timbers. At the right the hose is pictured a few minutes later after its inflation has been instrumental in shoving the concrete about 3½ inches to the right. Following this, the hose is deflated and the timber barred over to permit the placing behind it at each station of another of the series of 3½-inch blocks. The valves are then closed and inflation is repeated.

The backing-up pieces are blocks of wood 18 inches long, 10 inches wide, and 3½ inches thick. As pictured, they are inserted alternately in a vertical and a crosswise position. There are four of these fabricated struts to each 35-foot slab of concrete, and they are spaced roughly 9 feet apart. Following each shove, the hose is deflated, after which workmen bar the 10x10-inch timbers toward the face of the strip being transferred, thereby flattening the hose and permitting the insertion of an additional backing block. Three men are assigned to this work on each slab, and they can perform the necessary operations in less than a minute.

It requires 40 individual moves to complete the 12-foot transfer—five before the regular equipment is applied, and then 34 of 3½ inches each. The gap thus made is practically of the desired width. Measurements are next taken, and thin backing pieces or shims of the requisite thicknesses inserted to effect the final shove.

The 10x10-inch timbers along the face of the strip being shifted are not continuous, their length with respect to each 35-foot slab being 27 feet. The hose to be inflated is cut into corresponding lengths, and the ends of these are closed except for connections for ¾-inch hose—about 8 feet of the latter serving to link adjoining sections. Thus, when fourteen slabs of concrete are being moved simultaneously, pressure is brought to bear against only 378 feet of the 490-foot face, or against approximately 77 per cent of it. The hose is a standard product, termed suction hose by the manufacturer, and stands up remarkably well in this service. To protect it against damage, it is surrounded by canvas when in the opening.

The air is furnished by two 210-cfm. portable compressors. Each discharges into a 4x12-foot portable receiver. Two supply lines run from each receiver to the hose that does the actual work—making a total of four. These introduce air at four

equidistant points along the inflation line. The air is compressed to 100 pounds, but this may be cut down somewhat because observations have indicated that it is greater than needful. Movement of the concrete starts when the gauges on the expanding hose register about 20 pounds pressure, and it is apparently completed by the time the pressure reaches 60 pounds. To each section of the large hose is affixed a valve. By opening all of these after a full shove the air can be quickly exhausted.

One of the virtues of the method is that the pressure automatically adjusts itself all along the line. When the strip begins to move, the hose has an elongated cross section, with about 8 inches of its surface in contact with the concrete on one side and the backing timber on the other. As movement progresses, the hose gradually becomes circular in section, and the bearing surface on each side grows less, being reduced to about 3 inches by the time movement stops. Should it happen that one or more slabs lag behind the others, the bearing surface in contact with those slabs,

DRILLING AND GROUTING

After a section has been moved, it is set firmly in place by grouting. Eight holes are drilled through each 14½x35-foot slab, as shown at the left. A mixture of cement, top soil, and water is then introduced into these holes by the mudjack method (above), pumping being continued until it is certain that all open spaces are filled.

and therefore the area against which pressure is exerted, remains greater and tends to push them over abreast of their neighbors. As a result, virtually every slab moves in unison with its fellows. To assure accurate alignment, a check is made after each section is in its new position. When the writer visited the job, the greatest deviation recorded up to that time was found to be 5/8 inch. Such deviations are adjusted by inserting thin backing shims, as previously described.

Because of this automatic equalization of pressure, the concrete slabs, or 35-foot sections, ordinarily do not break apart at the transverse expansion joints. Where breaks do occur they are seldom more than an inch or two wide. In such cases, the slabs are pushed back in contact with each other by the same method employed to effect their lateral movement. Inspection of the slabs after shifting has shown that the concrete is not damaged in any way: all slabs are intact, and there is no breakage or spalling at the edges in touch with the ground.

SOURCE OF AIR SUPPLY

Two 210-cfm., air-cooled, portable compressors are stationed midway of the strip being moved. To provide a large volume of air for instant use, each machine discharges at 100 pounds pressure into a 4x12-foot portable receiver. Two air lines run from each receiver to the hose being inflated, the air being fed simultaneously at four equidistant points.

Aside from the portable compressors and air receivers, about 40 tons of equipment is needed for the work. All of this has to be transported before a start can be made on a new stretch. To facilitate these operations, there are provided small trucks designed for hand-pushing or drawing. Each group of workmen assigned to a particular slab loads its own equipment and hauls it to the new location. Usually only a little more than an hour elapses from the time one move is completed until another one is underway.

After a section has been shifted, it is firmly set in place by grouting. Eight holes, 2½ inches in diameter, are drilled through each 14½x35-foot slab. They are arranged in two lines parallel with and 44 inches back from the outside edges of the slab and are approximately 9 feet apart in both directions. The holes are drilled with "Jackhamers," a crew of two men and a portable compressor following close behind the concrete-moving gangs. Grouting is done by the mudjack method, a mixture of 1 part cement, 6 parts top soil, and enough water to give a rather thin consistency being pumped into the holes and well distributed over the ground on which the concrete rests. The grouting also serves to raise the pavement to the proper grade—the amount of elevation at the outside edge being 1 inch and at the inside edge ¼ inch. A new strip of concrete, 10 feet wide, is then laid alongside the outer edge of the transferred section, making each of the opposing travel lanes of the divided highway about 5 feet wider than it was originally.

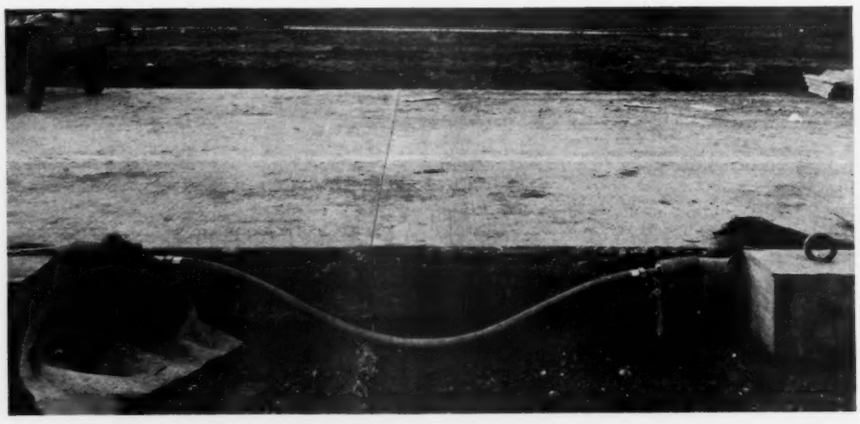
The New Jersey State Highway Department is carrying on the current work with its own force, being desirous of developing a satisfactory system for future use in connection with similar operations. The project is being financed by a $400,000 allotment of PWA funds. Because of the continually increasing efficiency of the organization as the men become more familiar with the work, it is impossible accurately to determine the cost. The estimate, based on the preliminary experiments, was $1.30 for each linear foot of pavement moved, including grouting. Mr. Johannesson states that this figure is amply conservative, and that it may be bettered considerably. In each linear foot are about 1.6 square yards.

Bids may be called for soon on the moving of an additional 8-mile stretch of the road. Although it is not customary for the highway department to restrict contractors, it is likely, because of the effectiveness of the compressed-air method, that it will be specified for that stretch. However, in view of the cost and the satisfactory condition in which the concrete is left, it is probable that the successful bidder will elect to use it, whether or not the state requires it.

The operations incidental to the shifting of the highway are spread out over a considerable area. Before a strip can be pushed over, grading must be done, and sometimes structures such as culverts, telephone manholes, roadside stands, telephone poles, and natural obstacles like trees must be removed. In its entirety, the project is giving employment to about 400 men.

Over the stretch of the New Brunswick Pike between Trenton and the Holland Tunnel, 90 deaths resulted from automobile accidents in 1934, and the majority of them occurred, as previously stated, along sections traversing rural regions, such as the one where the separation is now being effected. A check of the accidents that have taken place so far this year shows that 21.2 per cent of them involved cars traveling in opposite directions. By dividing the lanes such accidents will be eliminated, and highway officials believe that it will also reduce those between cars moving in the same direction, because some of them are undoubtedly caused by approaching traffic.

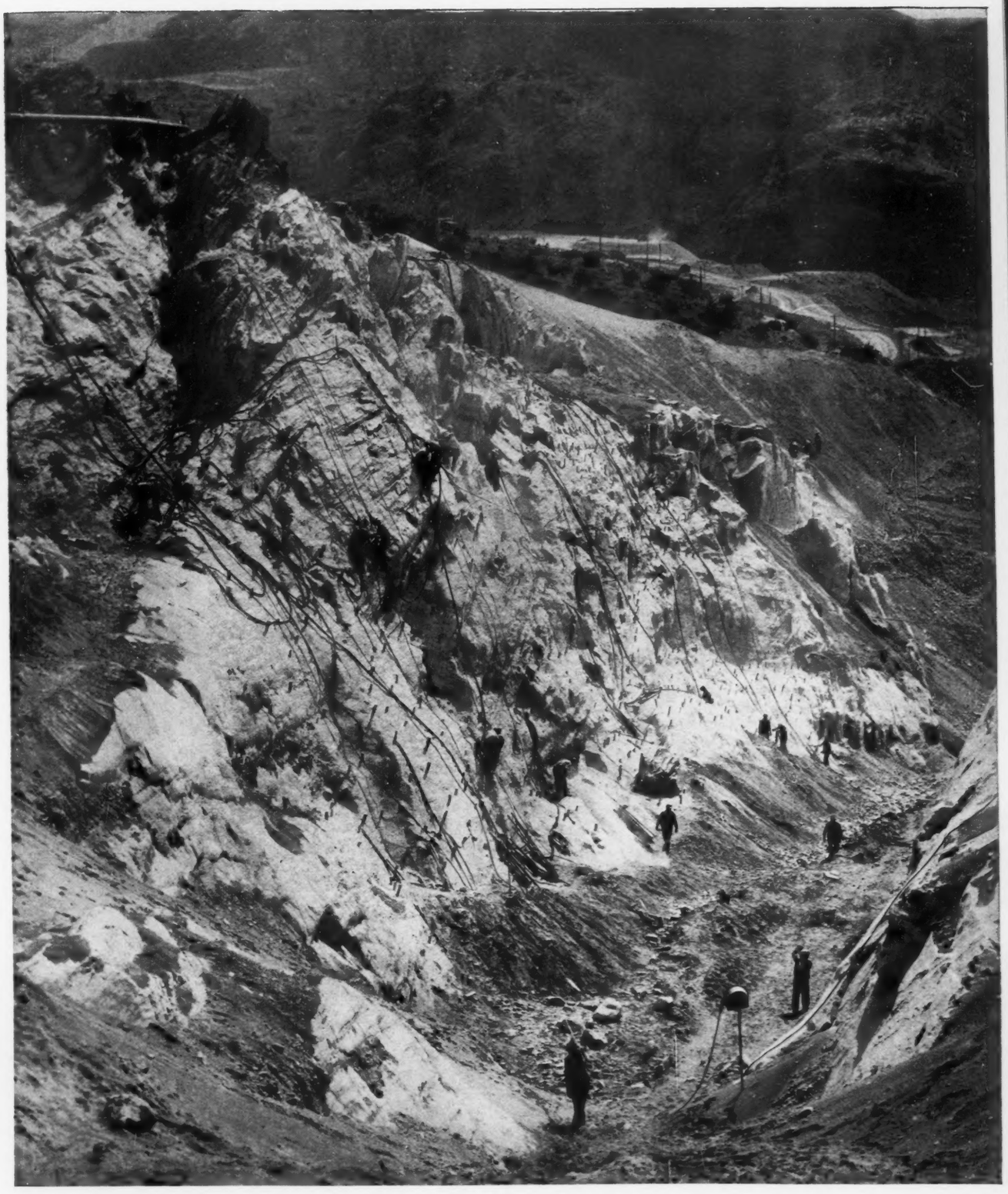
A sloping curbing will be placed on the inside edge of each of the 2-lane strips to guard against cars going off the concrete; and crossovers, permitting traffic to pass from one side to the other, will be provided at intervals. These will afford protection for cars waiting to make left turns into intersecting traffic. In addition, a center parkway is also expected to decrease the number of accidents involving pedestrians, as they will be able to make the crossing in two stages.



CONNECTION OF HOSE SECTIONS

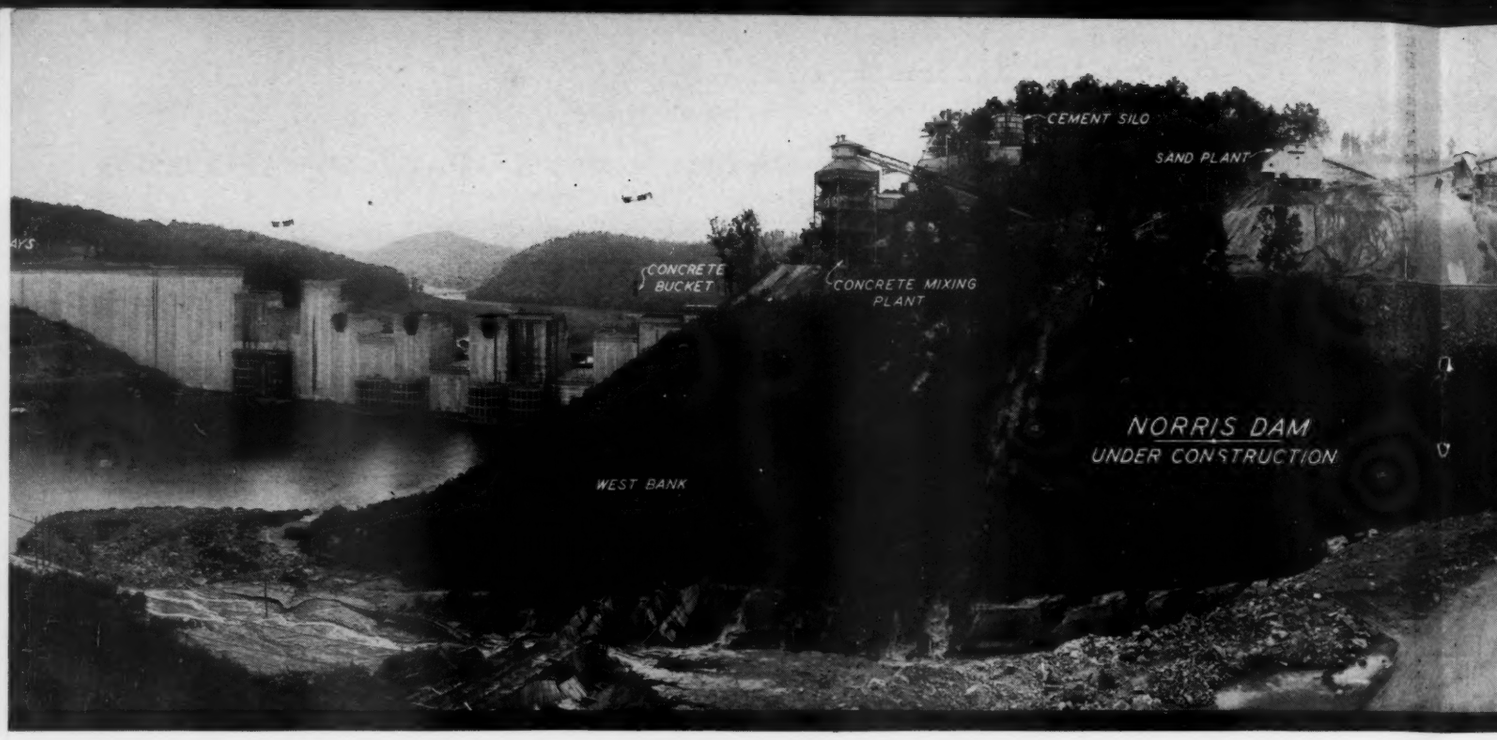
The hose which is inflated is not continuous, there being a 27-foot length for each 35-foot slab of concrete. These sections, or "bags" as they are termed on the job, are connected by standard ¾-inch air hose. At the left may be seen one of the valves for exhausting the air after each shove.

Glimpses of Large Construction Jobs



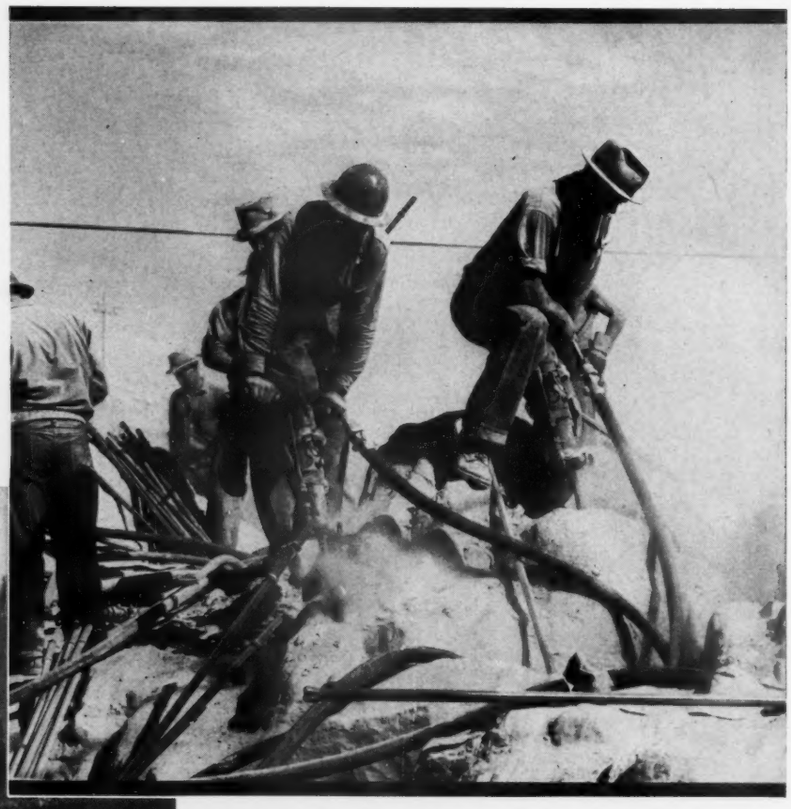
EAST-ABUTMENT CLIFF, GRAND COULEE

THE gorge of the Columbia River at the Grand Coulee dam site does not present the austerity that characterizes Black Canyon, the location of the Boulder Dam, but, nevertheless, its sides are highly precipitous. This view shows the concentration of activity on the east cliff, where drillers ride the open spaces in boatswains' chairs suspended by cables moored high above. Each of the dark marks is a peg inserted in a completed hole. Drilling in such places is attended by real difficulties in getting drill steel, powder, etc., to working points. The material blasted down is disposed of via the ravine at the base.



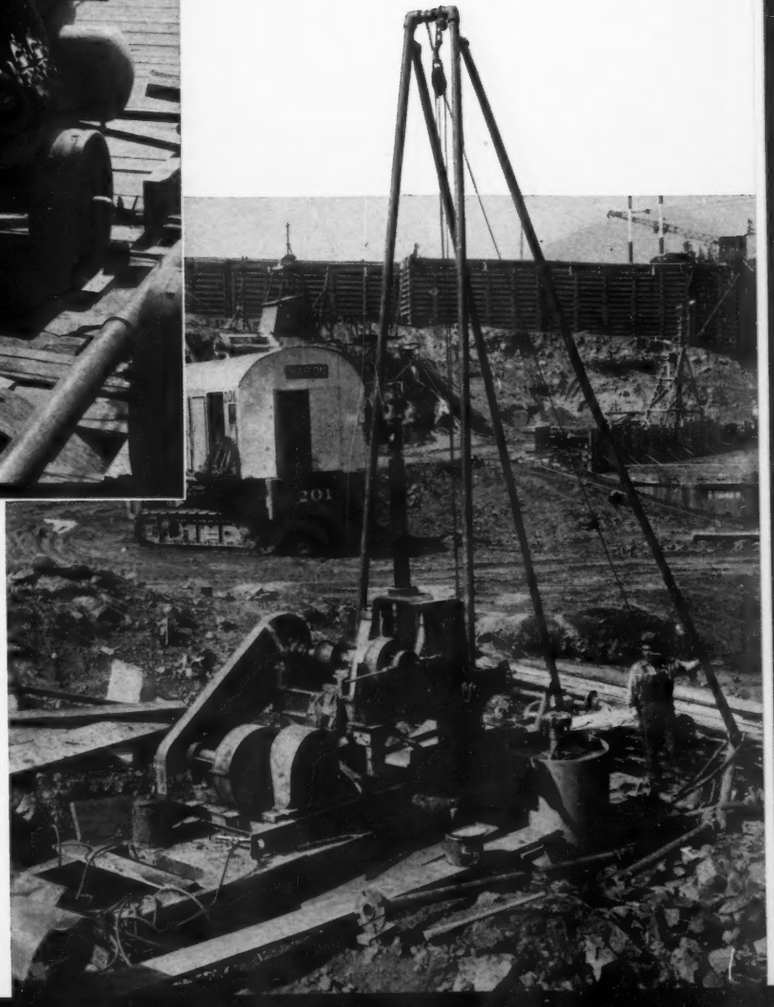
NORRIS DAM

Few large construction jobs afford an opportunity for as complete a view of all the principal operations as does the one presented in the picture above. Located on the Clinch River, about 30 miles from Knoxville, Tenn., Norris Dam was the first of several undertaken by the TVA. It is now nearing completion at an estimated cost of $34,000,000. At the right is the quarry, hollowed out of the sloping hillside. Limestone quarried with the aid of wagon drills is put through a primary crusher, carried to a secondary crusher, and thence conveyed to a sand-and-gravel plant for further reduction and classification. Aggregates thus produced are hauled by rail cars to a concrete mixing plant. Concrete is discharged into buckets, which are moved by rail around the hill to be picked up by one of two cableways, and placed in the dam.



GRAND COULEE DAM

The site of this mammoth concrete plug, that will arrest the flow of the Columbia River and permit the utilization of its water for irrigating more than 1,000,000 acres of now arid land, is blessed with sound and continuous foundation rock. Millions of cubic yards of overburden have been removed, and drillers are now biting away at the rock, as the action picture above proves.



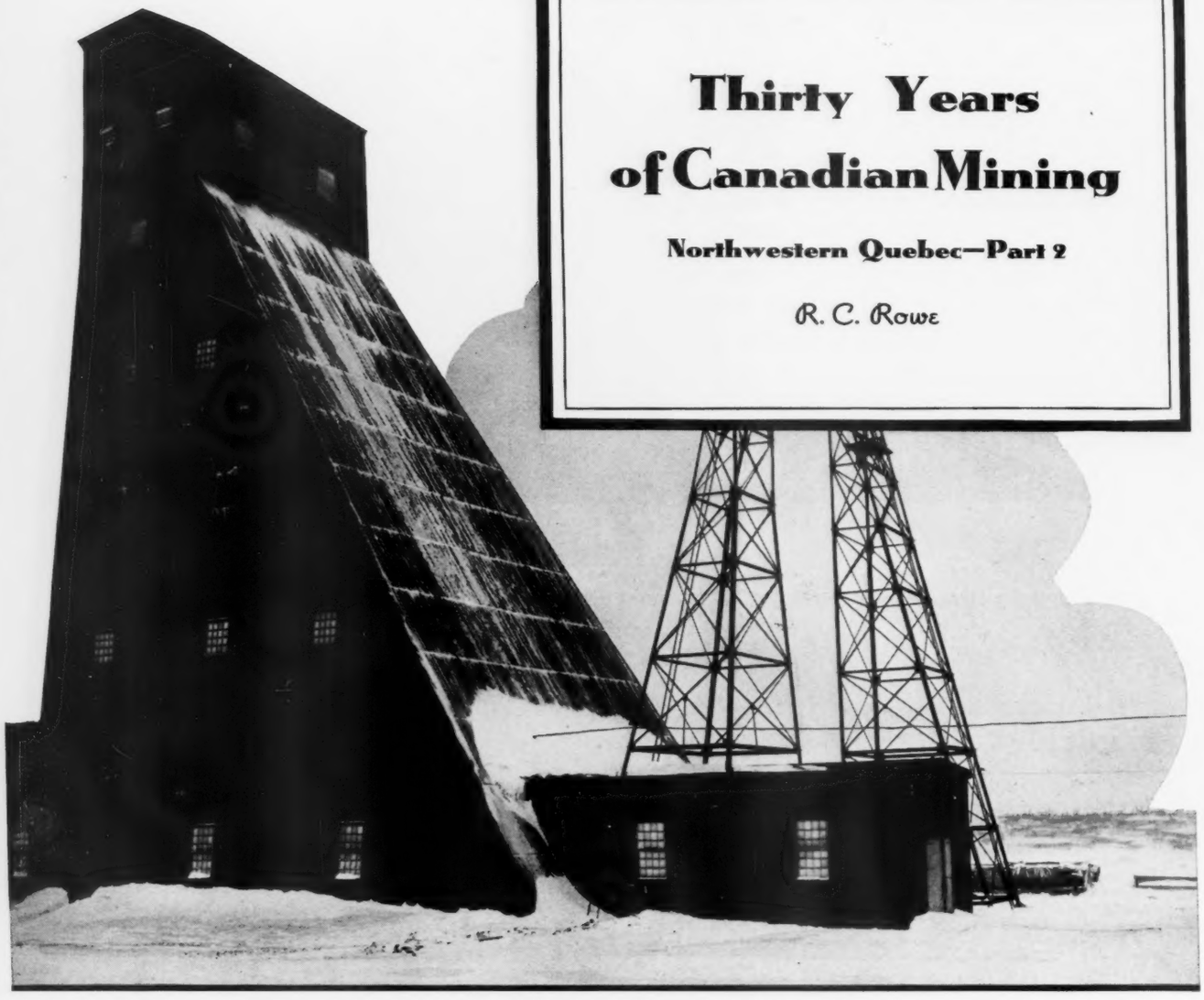
BONNEVILLE DAM

Work goes on at a rapid pace at this dam and power-plant project on the lower Columbia. At the right is a "Calyx" core drill taking a 36-inch sample of the foundation rock. These inspection holes are carried to depths as great as 60 feet. Above is a portable compressor contributing to the air supply required for the drilling operations. At the lower left on the opposite page are some of the 50 "Jackhamers" at work on this job.

Thirty Years of Canadian Mining

Northwestern Quebec—Part 2

R. C. Rowe



THE MAIN SHAFT HEAD AT THE NORANDA MINE

II

Which Deals With Its Development

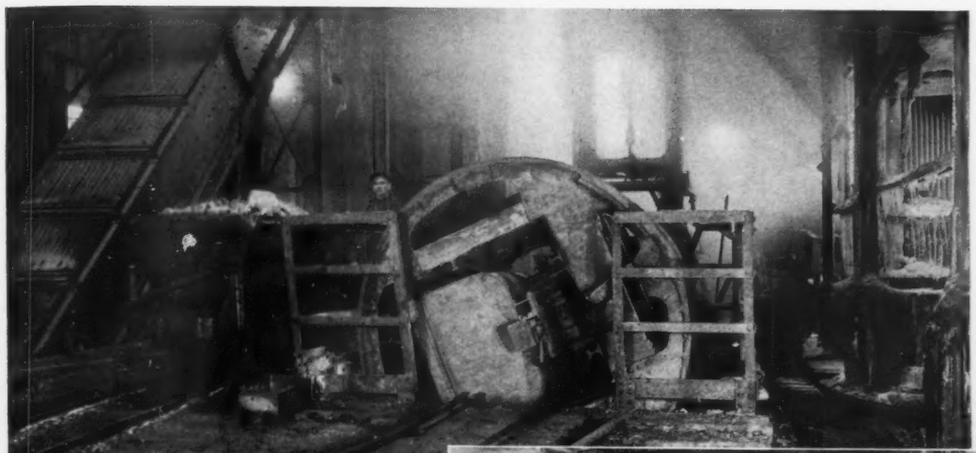
"Choose, ye investors in the future, choose!
Ye need pick cautious odds;
Tomorrow's fruit is seeded down today,
And unwise purpose like the unknown gods
Tempts on a wasteful way."

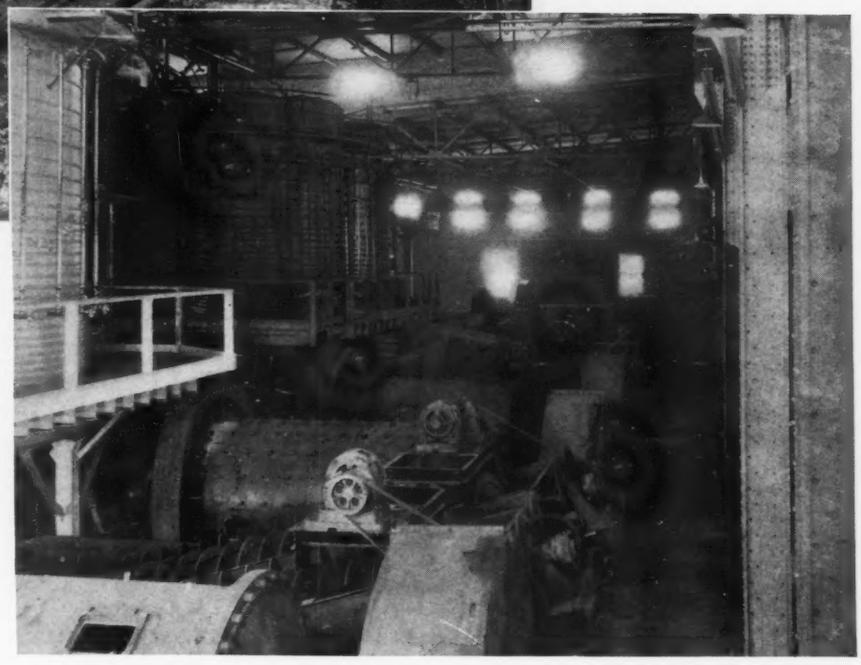
—Talbot Mundy.

THE development of northwestern Quebec can for the sake of convenience be said to have started about 1924, and all during that year diamond drilling was being carried out on the Horne properties. A prospect shaft was also put down on what was known as the No. 1 Ore Body. L. K. Fletcher was in charge of exploration and development.

During 1924 a town began to grow near the scene of the Horne discoveries. It was called Rouyn, being named after the township in which most of the activity occurred, and it spread around the shores of Osisko Lake with a good deal of alacrity and an equal amount of ugliness. Rouyn deserves more than passing mention because it was the last real mining boom town, and in some odd way it gathered to itself a picturesque individualism that was only comparable to Cobalt. In the heyday of the northwestern Quebec excitement it possessed all those characteristics that have been credited to mining towns by fiction and moving-picture scenario writers. It sprawled in indiscriminate and insanitary profusion along the shore line of the lake. It had dance halls, gambling halls, good hotels and bad hotels, and innumerable eating places that catered to every conceivable plane of society. Its streets were, naturally, unpaved, and in certain seasons were as dusty as ever the Sahara Desert could be, and in others as deep in mud as the muddiest road in war-torn Flanders. As the streets on such occasions were practically impassable to all but horses and strong, high-booted men, they were flanked by raised plank sidewalks which became wondrously slippery through the passage of hordes of muddied feet and therefore continually threatened to precipitate unwary pedestrians into the morass below. In those far-off days this writer once saw a small boy actually stuck in the mud of a Rouyn street, and he remained stuck until a high-booted stalwart rescued him.

Men drank, gambled, fought, and told incredible stories. They talked of long trails and distant places; of canoes and the gear of the road; of great, raw, strenuous things done; and of love in its lighter forms; of rumors of mineral finds which, if they had ever materialized, would have as-





AT NORANDA

The Noranda is one of the great mining establishments of the world. Its modern plant includes a fine concentrating mill and a smelter that can treat 1,000 tons of ore a day. At the left is a rotary dump for emptying cars at No. 4 Shaft Head. Below is a view of the ball mills in the concentrator.

tounded the world; and of weird and wonderful results obtained on properties which have since passed into oblivion. Rouyn then was an adventure. It had a quality of courageous hope and reckless optimism that infected any newcomer within an hour of his arrival, making him assume an attitude towards life that probably astounded him in later, saner years. In fact, eminently respectable individuals did things and undertook venturings which undoubtedly made them wonder afterwards whether they did not go a little mad in those good old crazy days. Very likely they did, but they are probably the better for it.

The trail to Rouyn became known to the waggish and jocular gentry of the North as "The road to ruin," and the play on the picturesque name captivated the fancy of many a man. Among them was "Jock" Murray, who was a man of some parts (having been an editor of *Canadian Mining Journal*) and a dexterous juggler of verse. He wrote a poem about it, as follows:

ROUYN, OR WHAT'S IN A NAME?

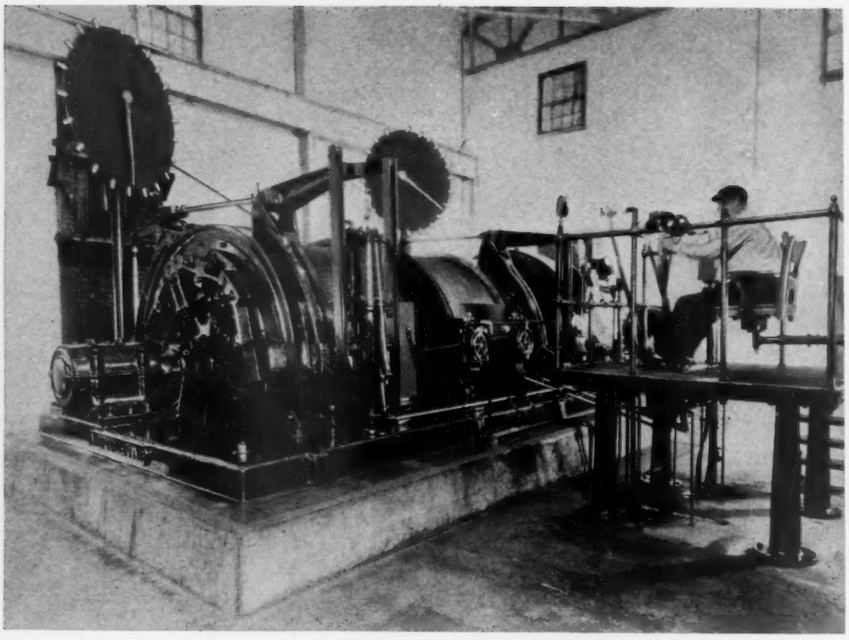
Where wolverines their greed assuage,
  Where gambols portly Bruin,
Where moose live to a goodly age,—
  (The place I mean is "Ruin")—
Where there is neither shop nor house,
  Where one can't get Chop Suey,—
That hash of cabbage, cat and mouse,—
  (I now refer to "Rouee")—
Where white the moon shines down on men,
  The silvern, northern moon,—
(Where time and time and time again
  One hears the name called "Roon")—
'Tis there, 'tis there that I would be,
  Far, far from human clatter:
(And not one tinker's dam to me
  Pronunciations matter.)

Later, of course, came the inevitable reaction. Quieter elements became more predominant, and order and sanitation were introduced. Rouyn passed its riotous youth and settled into more placid ways of life. The streets were paved, and the old raised sidewalks, with all their perils, their incident, and their pitfalls, gave place to concrete. The tough birds moved on, and the hordes of long-booted stalwarts disappeared. Across the bay there grew a more orderly town as the Horne property developed into a great mine, a town that was the product of careful planning and the solicitude of considerate employers who wished to give their men comfort and conveniences.

But Rouyn went on, and everything about it refused to become commonplace. It will always remain a remarkable piece of psychological foresight that the founders of the sister town did not pick for it an ordinary name. Had they done so, Rouyn would have overshadowed it for no reason at all except the power of a name. But they didn't, they called it Noranda, which sounds pleasanter than Rouyn and has not got the sinister word play that characterizes the latter.

So Noranda has thrived under the wing of a powerful company, while Rouyn has gone its own individual way. Instead of expanding it contracted for some years after the bold, bad, wild days of its youth. Thus they make an ideal pair, sitting on each side of the bay in Osisko Lake, Noranda neatly laid out in blocks with the tall stacks of the smelter looming over it, and Rouyn sprawling in unmathematical and doubtful splendor along the shore line and retaining in some odd way quite its own that indefinable quality that we can sense in those mysterious people who have had "a past."

Meanwhile, during 1924, the district in general presented a scene of great activity, but most of it was of the prospecting type. Work was proceeding on the Amulet claims which were staked early in 1923 by Pete and Joe McDonough; and it is a curious fact that the most important ore body on this property was located by chance by the employee of another company who happened to be going across it.



NORANDA HOIST

A Canadian Ingersoll-Rand 96x48-inch electric hoist which brings ore to the surface. It exerts a rope pull of 18,000 pounds.

The main ore body of the Waite-Montgomery was also uncovered in 1924. The property took its name from "Ike" Waite (christened Cecil), an engineer, and Tom Montgomery, a prospector. There is a pretty story about the finding of this ore body that involves a bear and certain picturesque incidents; but the real fact of the matter is that Montgomery noticed the peculiar color of the soil—which proved to be soil and decomposed sulphides—around the roots of an upturned tree. Trenching later disclosed the ore body, which is a mixture of copper and zinc.

The country between Rouyn, which was the center of these discoveries, and Lake DeMontigny, where the earlier developments were struggling along, was naturally receiving a great deal of attention on the part of prospectors, many of whom were still searching for gold, and during 1924 the first strikes in Malartic and Cadillac townships were made. The most important and impressive of these was the property which later became known as the O'Brien-Cadillac—the first part of its name being derived from the interests that acquired it, and the latter from the township in which it is located. At this point we may digress for a brief while to remark that the record of the O'Brien interests (operating under the name of M. J. O'Brien, Ltd.) in northern Canada is remarkable.

The entry of Senator O'Brien into northern mining began with Cobalt and at the very start of that famous camp's colorful history. The O'Brien was one of the early producers in Cobalt, and today, after nearly 30 years, is the only one left. Subsequently the O'Brien interests entered the Gowganda silver area and took over the claims which afterwards became the Miller Lake-O'Brien Mine. The story of this mine is one of courage and extraordinary efficiency; and a great deal of money was spent on it before it became a producer. It has, however, yielded steadily since then and has kept going through all the years of low silver prices. It is now, and has been for some time, the only producer in Gowganda. It has been under the management of D. J. Kennedy for many years. This is an astonishing record, and the man who has been largely responsible for it is J. G. Dickenson, who has directed the northern activities of M. J. O'Brien, Ltd., since the early days of Cobalt.

But the O'Brien record did not stop at silver, for the O'Brien-Cadillac was a producer from the "grass roots." It was a most picturesque deposit consisting of smoky quartz which was literally threaded with gold in places—so much so, in fact, that one old-timer, with all the customary enthusiasm and love of embellishment of his kind, described it to the writer as "a vein of gold with a little quartz in it." That, of course, was something of an exaggeration, but the fact remains that samples from the O'Brien-Cadillac were among the most impressive ever seen, and high-grade ore was shipped continually during the period of development.

During the same year the McIntyre-Porcupine optioned the group of claims that was controlled by R. Gamble and that later became the Granada Gold Mines, Ltd. It was on one of these claims that the first discovery of free gold in the sediments was made in the area. In the course of 1924, as many as 92 companies and syndicates were engaged in active work from the Ontario border to Dubuisson Township, a distance of approximately 80 miles.

In 1925 the Abana Mine, a deposit of copper-zinc, was found. This property was somewhat ill-starred and never came into production. It was later acquired by The Mining Corporation of Canada, Ltd., a famous Cobalt company which has mining interests throughout Canada. During the same twelvemonth the Aldermac Mine was uncovered. It was named after the two well-known consulting engineers W. P. Alderson and A. A. MacKay, who finally made it a producer of copper concentrates and pyrite. The year was characterized by feverish activity, and the whole 80-mile area was overrun by prospectors. The number of claims recorded during the fiscal year of the province was 5,143, compared with 1,750 in 1924.

But 1925 was famous for other reasons, among them being the historic railway controversy which began through the expressed desire of the Nipissing Central Railway to extend its line into Rouyn. The Nipissing Central is owned by the Ontario Government and connects with the Temiskaming & Northern Ontario Railway—also owned by the Ontario Government—which, in its turn, connects with the Canadian National and Canadian Pacific railways at North Bay. The Temiskaming & Northern Ontario tapped and still taps all the thriving mining camps of northern Ontario, which are largely controlled from Toronto. As a result that city was and still is reaping an almost incalculable benefit in trade.

It was therefore perfectly natural that Quebec should view with some alarm the tapping of their new and promising mining field by a road that was essentially a feeder for Toronto. Such a development could only lead to the diversion of the flow of trade to that city instead of to Quebec points. This alarm became so definite that the Quebec Government refused to permit the Nipissing Central to extend its line beyond the Ontario boundary into the Province of Quebec, and then the fat was in the fire.

The outcome was a controversy that fairly shook the relations between the two great provinces. The matter was further complicated by the undeniable fact that it was mostly Ontario money and Ontario interests that were developing Quebec. Toronto by this time had become completely mining-minded, but Montreal had yet to see the light. The inevitable result of all this was that the mining interests in northwestern Quebec vociferously added to the clamor; but the Quebec Government, with its usual *sang froid*, refused to be stampeded, and there the matter stood.

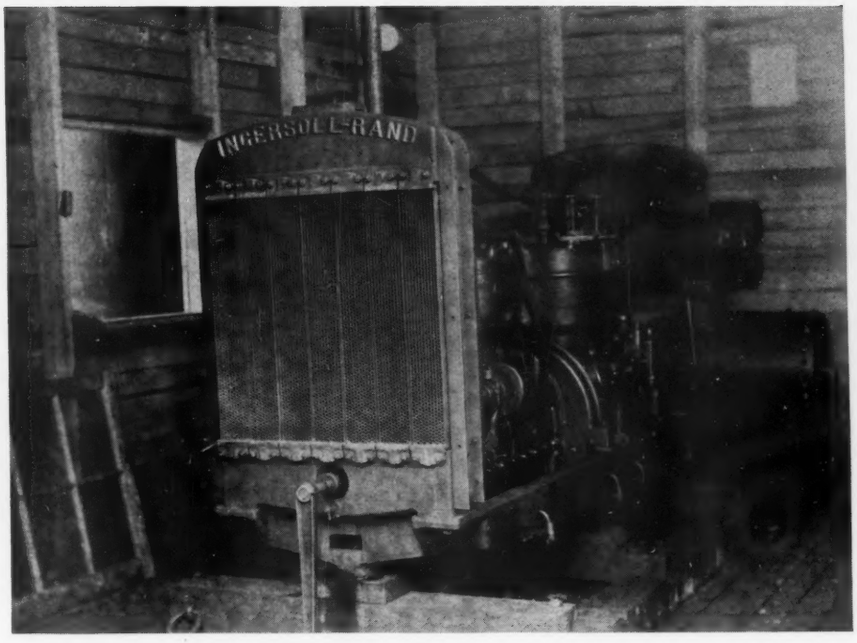
Meanwhile the Canadian National was considering the advisability of running a branch from its transcontinental line—from a station called O'Brien (but later changed to Taschereau)—to Rouyn. As an example of the utter lack of appreciation on the part of Montreal of the mining possibilities of the new area, it might be mentioned that the *Montreal Gazette* bitterly

attacked the projected line as a waste of public funds. However, the Quebec Government stood pat, and to the everlasting credit of the Canadian National Railways it can be stated that the branch line was started late in 1925. The Ontario Government had not, however, accepted the course of events with any placidity, and proceeded to combat the right of Quebec to block its railway by taking the case to the Privy Council. Eventually the Privy Council handed down a judgment in favor of Ontario, and the Nipissing Central was put through, so that in the end the new district was served by two railways.

During 1925 work went on rapidly at Noranda Mines, and towards the end of the year it was decided to construct a smelter, which was begun early in 1926 and was designed to treat 1,000 tons of ore per day. It was at this time that the Timmins interests, which had played so great a part in Cobalt and Porcupine, took a very definite hand in northwestern Quebec affairs. Noranda Mines, Ltd., had spent a great deal of money in the development of its property, and funds were required to finance the building of the projected smelter. The sum needed was a large one and was not easily obtained except on onerous terms. N. A. Timmins and his associates came to the rescue and advanced $3,000,000 to bring the property to production. No matter how one looks at it, $3,000,000 is a lot of money; and the district in general owes much to Mr. Timmins for the chance he took in the interests of mining in general and northwestern Quebec in particular.

The year 1926 was one of terrific activity in the whole area, and more than 9,000 claims were staked. Work was carried out on a large number of properties; and machinery and supplies were lugged miles through the bush under appalling transportation difficulties. As we have stated, large tracts of the country were low-lying, and men performed prodigious tasks in cutting roads and moving machinery. The general conditions brought the portable air compressor much to the fore; and this piece of equipment revolutionized not only prospecting but also development in its early stages.

Until the advent of the portable compressor, those who wished to use power in opening up isolated mining properties had to rely on steam-driven compressors. Steam meant boilers, and boilers meant weight, and the land over which men dragged these heavy, cumbersome loads in those earlier days almost beggars description. If one visits the older camps such as Gowganda, boilers that are now but rust-eaten shells can be seen with trees growing through the ruins of the buildings that housed them. Hope was the force that spurred on the pioneers to face tasks of transportation that would have seemed impossible of accomplishment under ordinary circumstances. Ingenuity, courage, and bull strength were the ingredients that lugged machinery into these inaccessible places;



POWER FOR DRILLING

Portable compressors such as this one have helped to open up many properties in the Rouyn district. Mounted on skids, it can be moved quickly and set up easily. A turn of the crank of the gasoline engine starts it.

but when hope died, and operations were finally stopped, the boilers were left. There was nothing else to do with them because their value was not sufficient to absorb the tremendous cost of moving them.

The portable compressor changed all this. It was self-contained, and it was compact. It could be hauled to remote points with reasonable care (note we say "reasonable," which does not mean that, in virgin country such as northwestern Quebec then was, it was too easy) and in a few hours connected up and put in service. If the particular spot in which the machine was operating did not prove to be satisfactory, the whole outfit could be taken elsewhere. It gave the business of developing mining properties an elasticity and mobility that had been missing before; and, as a natural consequence, it was widely adopted in northwestern Quebec where it played a prominent rôle in the work of development. It might be remarked here that the requirements of changing days have been met by manufacturers of such equipment. Today whole mining plants are designed to be knocked down to parts small enough to be transported by air to the most outlying sections of Canada. But this will be touched upon later in this history.

Another innovation introduced and extensively used in northwestern Quebec was geophysical prospecting which, broadly, consisted of detecting sulphide ore bodies through overburden. Here again the peculiarities of the district lent themselves to the adoption of a new method. It should be stated that geophysics is an accredited science which is an aid to the geologist and to the mining engineer. First applied as such in the area during 1926, it later—in the glamour and excitement of a new day—unfortunately became the tool of the promoter in certain cases, and the results of geophysical surveys were the basis for promotions of doubtful value. It must be noted, however, that many geophysicists did not lend themselves to promotion purposes, and that many saner heads counseled that too much must not be expected of the new science. But the flood of optimism submerged their voices, so that geophysical prospecting suffered a loss of prestige in the inevitable reaction from which it has never really recovered in Canada, in spite of the fact that it has come to be accepted as standard practice in many countries.

The spread of activity in Quebec can be best appreciated when it is remarked that 12,686 claims were registered in the fiscal year ending 1927, and 13,707 in 1928. During those years operations were spread over all the district. The number of companies formed was legion. Some were simply promotions hitched on to mere options on properties. In many instances practically no work was done: in others a great deal of surface and underground work was carried out. Those were the days when the great wave of credit inflation was nearing its crest, and promoters reaped a golden harvest.

Caught in what we now know to have been the last crescendo of the mad dance of those mad times, northwestern Quebec presented a spectacle of unbridled and riotous optimism. Sane men seemed to lose all sense of proportion and to suffer from a form of mental astigmatism. The writer saw so-called copper mines which consisted

SISCOE DEVELOPMENT

The Siscoe was discovered in 1911, but eighteen years elapsed before a mill was erected there. It is now a consistent producer. The picture below shows the property during an early stage of its development: the one at the right as it appeared in 1928.

of nothing but sparsely disseminated grains of chalcopyrite. They were shown to him with gravity and almost reverence by men who probably would never have looked at them twice under normal conditions. They were quite sincere, but their judgment was warped by conditions, just as the judgment of men was being warped in the cities to the south. Properties changed hands quickly and often, and companies were financed almost overnight. The writer remembers seeing $40,000 worth of stock sold within two hours on the train *en route* to Rouyn; and it was sold to hard-boiled mining men. Work was going on in 29 townships, or in an area of nearly 3,000 square miles.

Towards the end of 1927 the smelter of the Horne Copper Corporation (subsidiary of Noranda Mines, Ltd., which was later absorbed by the latter) was blown in, and the discoveries of Horne and Miller therefore supplied the first producer in the new district. During 1928 the famous "H" Ore Body of Noranda Mines was located. It is this great ore body, together with its continuation, "the lower H," which has made Noranda one of the great copper mines of the world.

The following year witnessed the beginning of the inevitable reaction to the boom. Many companies dropped out of the picture, and operations began to slow up very perceptibly. On the other hand, Noranda Mines forged ahead with an increasing output of copper, and plans were laid for an electrolytic refinery in Montreal East. As a result, Canadian Copper Refiners, Ltd., was incorporated with Noranda Mines in control but with British Metal Corporation, Ltd., and the Nichols Copper Company participating.

Meanwhile ore was being shipped from the Waite-Montgomery Mine to the Noranda smelter; and it might as well be mentioned here that this property was subsequently absorbed by Noranda. A mill for the concentration of the ores of Amulet Mines, Ltd., was also begun in 1930. This property was likewise taken over by Noranda. At the eastern extremity of the district a 100-ton mill at the Siscoe Mine was put in service in January, 1929, eighteen years after the discovery of that mine.

During the same year Leo Springer found copper at Lake Opemiska, 25 miles west of Lake Chibougamau. These claims were later acquired by Ventures, Ltd., which has done a considerable amount of work on them indicating extensive ore bodies. However, the property still awaits more favorable development in the copper market before coming into production.

In 1930 the full force of the depression and the normal reaction to a boom period struck the district. Base-metal prices were tobogganing downward, and the search for copper and associated metals consequently lost its flavor. The craze for copper which had struck the prospecting mind with such dramatic suddenness seven years before faded fast. Properties closed down one after another with a rapidity that dazed the Town of Rouyn and left it groping amid a mess of ruined hopes. The district was settling down into that state of coma which characterized it for some time until the advances in the price of gold once more galvanized it into activity. There were, however, some bright spots in the rather somber picture. In the first place, Noranda was still forging ahead and becoming a greater mine almost every week; Siscoe was yielding gold; the Granada gold mine south of Rouyn came into production; and high-grade gold ore was being shipped from the O'Brien-Cadillac.

During 1931 the value of the gold obtained from the Noranda exceeded that of copper, with the result that it became primarily a gold mine. In the same year the Beattie, in Duparquet Township, was starting to attract a lot of attention with its huge low-grade ore body. Some 5,000,000 tons were indicated, averaging more than 3 pennyweights of gold per ton. The property had come under the control of Ventures, Ltd., and the Nipissing group of Cobalt was heavily interested in it. It may have been noticed that Ventures, Ltd., has been mentioned twice in connection with the development of northwestern Quebec, and it is probably in order to note that it is an exploration and development company established some years ago. It has made a very considerable contribution to mining in Canada; and its many activities are directed by Thayer Lindsley, its president. The Ventures interests brought the Sherritt-Gordon copper mine in northern Manitoba to production, also the Falconbridge nickel mine in the Sudbury region. They likewise made the Beattie gold mine a producer, and they have properties and mines in different stages of development throughout Canada, not to mention a nickel refinery in Sweden.

Returning, however, to the course of events in Quebec, we find that 1932 saw the beginning of the gold boom that was going to strike the district. Gold had not yet started its meteoric climb; but the ever falling cost of labor and materials was making gold mining more and more attractive. The old adage that "bad times are good times for gold mining" was being resurrected, and the precious metal was rapidly becoming king again.

TOWN OF NORANDA

This camp (left) never knew the tumult and riotous life of its neighbor, Rouyn. It grew in orderly fashion during the development of the mine for which it is named and whose smelter and shaft head loom above the horizon.

PERRAULT STREET, ROUYN

A summer scene in the days before paving came. Mr. Rowe vouches for the fact that mud was so plentiful and tenacious that a small boy was once stuck fast in it.

At the beginning of the year there were three gold mines in the area besides Noranda. These were Siscoe, Granada, and Venus—the latter being a small one. By the end of the year milling plants were in operation on the O'Brien-Cadillac and the Bussieres, bringing the total up to five. In addition, Beattie Gold Mines, Ltd., was constructing an 800-ton mill; and several important gold discoveries had been made in different parts of the district. These were developed through the succeeding years, and by the end of June, 1935, twelve mines were producing gold while others were installing treatment plants. The twelve producers are as follows:

Rouyn Township—
- Noranda Mines, Ltd.
- Granada Gold Mines, Ltd.
- McWatters Gold Mines, Ltd.

Duparquet Township—
- Beattie Gold Mines, Ltd.

Cadillac Township—
- Cadillac-O'Brien

Fourniere Township—
- Canadian Malartic Gold Mines, Ltd.

Dubuisson Township—
- Siscoe Gold Mines, Ltd.
- Greene-Stabell Mines, Ltd.
- Sullivan Consolidated Mines, Ltd.

Bourlamaque Township—
- Lamaque Gold Mines, Ltd.

Pascalis Township—
- Perron Gold Mines, Ltd.

Louvicourt Township—
- Bussieres Mining Company, Ltd.

In addition to these mines there are a number of others where construction is going forward. Among them might be mentioned Arntfield Gold Mines in Beauchastel Township, Stadacona Rouyn Mines, Ltd., in Rouyn Township, while the Thompson-Cadillac has a mill but is at present not operating.

This, in a manner of speaking, brings the history of northwestern Quebec up to date, and in the telling of it we have traveled a long way and covered a considerable length of time; but before turning to our concluding review it is proper to trace briefly the effect that other districts have had upon its development. All through this story there has been a thread of sequence that shows how one mining district is related to those that preceded it; how men have brought the experience and money gained in older fields to the operation of newly discovered ones; and northwestern Quebec has proved no exception to this rule.

BEATTIE MINE

This property in the northward-lying Duparquet Township has a 5,000,000-ton deposit of low-grade gold ore. It is controlled by Ventures, Ltd., a concern that has played and continues to play an important part in the development of Canadian mines.

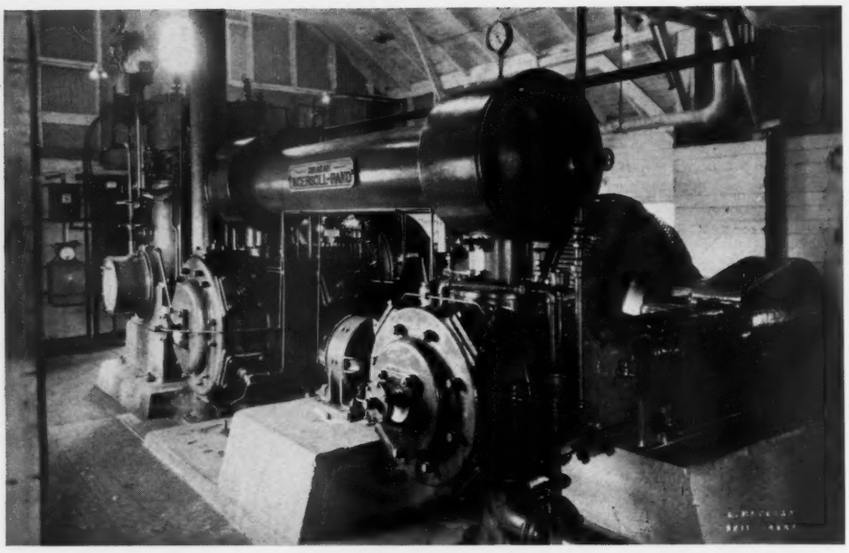
Noranda, with its various affiliations, is the outcome of other fields. It was Toronto money that developed it; and it was Porcupine money that helped it over a bad spot. Lamaque Gold Mines, Ltd., is a subsidiary of the Teck-Hughes of Kirkland Lake; Canadian Malartic is a Ventures, Ltd., product; and the Greene-Stabell was brought to production by John E. Hammell who has already been introduced in connection with Cobalt and Porcupine. Other great mining companies have interests all through the district. Consolidated Mining & Smelting Company, Ltd., is busily engaged in Chibougamau; Nipissing Mines of Cobalt is heavily interested in the Beattie; while McIntyre-Porcupine, Dome Mines, Sylvanite, and a number of others are developing properties.

III

Which Is Something of a Review

"Of the men many as sands, of the squadrons ranked and massed
Who are passing, changing always, and never have changed or passed."

WE HAVE said somewhere before in this part of our chronicle that northwestern Quebec differs from all of the other camps which we have reviewed in the matter of size. It also differs because of the fact that it has not yet passed the peak of its development. Just how far that develop-



COMPRESSOR AT O'BRIEN-CADILLAC

Although portable compressors are of inestimable aid in opening up properties, a mine that comes into steady production finds it more advantageous to install large stationary units. This one is a 2-stage Class PRE of 1,518 cfm. piston displacement. It is driven by a 250-hp. synchronous motor.

ment will go before it reaches its ultimate conclusion we are unprepared to say; but we may safely predict that it will go far. The area is large, and its possibilities have by no means been exhausted. There is the further point that we really know very little yet about its fundamental structure. We do know that conditions favorable to the deposition of gold continue to great depths in such fields as Kirkland Lake and Porcupine, but things such as these have not yet been determined in Quebec. We know that there are very essential differences in the character of the ores themselves; but what effects these differences may have on the lives of mines we do not know. Of course, there are the incurable optimists who pierce these mists of uncertainty with positive assertions that what has been proven elsewhere will eventually be fact in Quebec; but while we may discard these assertions, they do at least indicate that the district is in its infancy so far as development is concerned.

In any case, these matters, which are in the nature of prophecy and touch on the future, hardly belong here, because we are mainly concerned with history—with a recital of the past and of accomplished fact. And one of the accomplished facts is the number of mining towns that has sprung up in various parts of the area. We have mentioned Rouyn and Noranda; but there are others whose names are alive with the beauty of old France—Duparquet, which is adjacent to the Beattie mines; Val d'Or, Valley of Gold; Lamaque, which belongs to the Lamaque Mine; Clericy, which dreamed of a splendor that never quite came. They all belong to mining, and they have their roots in utility and practicability, but their names are alive with a suggestion of older places and softer lands. These towns are concrete evidence of what mining has done for northwestern Quebec. They have sprung up in a country that was bush, rocks, and muskeg only a few years ago. Good roads connect them now, and you can reach them by a variety of conveyances equal to anything procurable in the more thickly populated sections of the world.

And there are other names in the history of Quebec—those of men, the men who have made it. Some of them have gone up, some have gone down, and some are dead in the inevitable course of things. Some of them have given their names to mines, others have left no mark but that accorded them by memory; but one and all they have had a hand in the making of a great mining district.

There are such names as Jack Gale, Murray Christman—whom everyone knew as "Merry Christmas," Eddie Carriere, Paul Dufault, Angus MacIntosh, Jim Sullivan, Hertel Authier, and J. Renault, who first struck gold near Lake Fortune back in 1906. There was Robert (Bob) Clark who was one of the pioneer stakers around Lake De Montigny and who was killed in a motor accident on May 18 of this year after finding another mine near Dryden in Ontario. There was Billy Greene who played a part in the early history of the Greene-Stabell which Jack Hammell eventually brought to production. He was burned to death in a bunkhouse fire in the Kirkland Lake district. There was Stanley Siscoe, who discovered the Siscoe Mine and rode to fortune with it after years of waiting. His frozen body was found last winter near Senneterre not so many miles from the mine that bears his name. He chartered a plane from Montreal to take him to Senneterre, but heavy snow forced it down on a little lake. For nearly a week he and the pilot lived in a deserted trapper's shack while airplanes scoured the land in spite of frightful weather conditions. In the end, Siscoe, confident of his bushcraft, attempted to walk out to Senneterre; but the wilderness which he had fought and conquered for years claimed him, and the pilot of a low-flying search plane found his crumpled body. There was young Ken McPhayden of Amulet, who is dead; the late Russell Popham, president of the company in the early days, who put his last few thousand dollars into the mine and then acquired wealth; and F. M. Connell, the man who put Amulet on the map and who, it may be remembered, we mentioned as buying a claim in the Gillies Limit in the old Cobalt days. Today he is a director of Noranda Mines; and he has had a hand in other matters which will be related later.

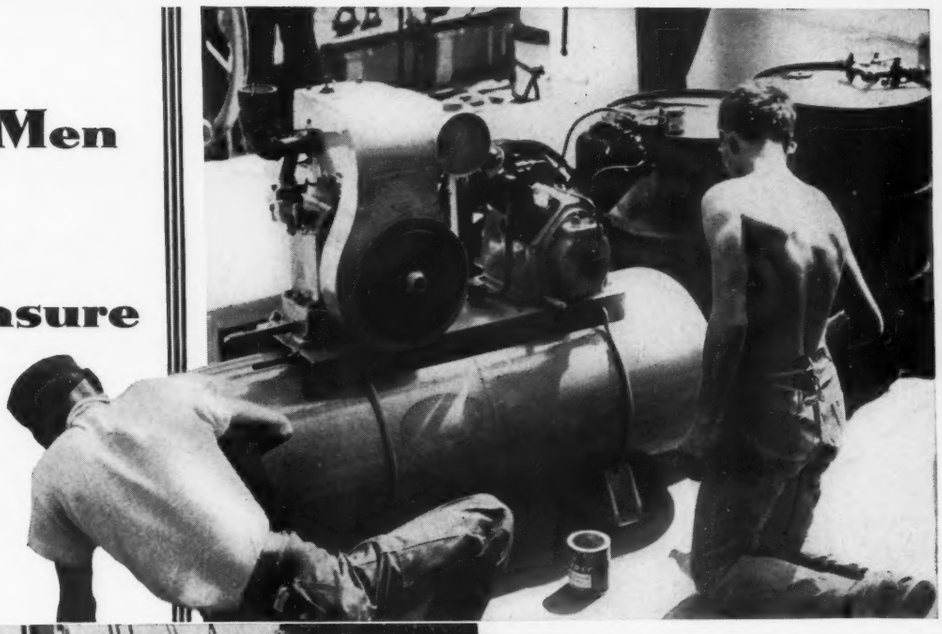
And in this recital we must never forget Edmund Horne, who was, in a manner of speaking, responsible for it all. He is a gentleman of substance now, with a model farm in Nova Scotia and "a say" in the operation of the great mine he discovered. There is a long list of Noranda men, and each one has contributed a great deal to the advancement of the district as a whole and the development of the mine in particular. We have mentioned L. K. Fletcher who was in charge of the early exploratory work. Later came Ernest Hibbert who was general manager for some years, finally becoming a director of the company and its consulting engineer, his place as general manager being taken by H. L. Roscoe.

There are such men as W. P. Alderson and A. A. MacKay of the Aldermac. Alderson is now in Kenya, but MacKay still concerns himself with the problems of the Aldermac Mine. There is Harry Kee who, as we have seen, has had a hand in many things in many parts of the country. He brought the Sullivan to production. There are Bob Bryden, who ran the O'Brien-Cadillac, Tom Montgomery, the Springer brothers, Bob Gamble, Colonel Scott-Williams, John Caldwell, and a host of others. Their names pass before the mind like an army—engineers, prospectors, aviators, and men of no fixed occupation—just drifters in a country that calls for individualism. In some cases their names stick in memory on account of accomplishment, in others because of their human characteristics, for such is the way of life.

But one and all they did something: each one contributed something, be it great or small, to the ever widening circles of endeavor that spread out from Rouyn and Noranda like the ripples from the spot where a stone has been thrown into a still pond. And the story is not yet told in its entirety, for the circles of effort are still reaching out, but with the difference that they now spread from several and not from one center, as they did in the older days, and that the distances affected by them grow ever greater.

This is the eighth of a series of articles by Mr. Rowe. The ninth will appear in the January issue.

Providence Men Seek Sunken Treasure



Providence Journal Company

AFTER A $17,000,000 PRIZE

The *Liberty* at her dock in Providence the day before she set sail for the Delaware Capes and, at the top, members of the crew applying a coat of paint to the Type 30 compressor on which the divers rely for an uninterrupted supply of air.

A FEW weeks ago the old Boston pilot schooner *Liberty* slipped out of the Harbor of Providence, R. I., and headed for the Delaware Capes on a most romantic mission—the search for sunken treasure. Aboard her were eleven men and everything in the way of gear and paraphernalia with which to carry on salvage operations.

The object of the expedition is to recover $17,000,000 in gold from the wreck of the British sloop-of-war *Braak*, which went to the bottom of the sea at the entrance to Delaware Bay in 1789 with loot from at least two Spanish galleons. Several previous efforts to recover the prize have failed; but the syndicate of Providence men that is financing the present quest has made elaborate preparations and is confident of success.

The *Braak* sank in relatively shallow water, and until about 100 years ago the tops of her masts were visible above the surface. Before the action of the seas effaced all evidence of the wreck, bearings were taken of her position, and these have been used in relocating her. For weeks, small boats have put out from shore dragging chains between them, seeking to catch hold of the sunken hulk. Gradually they closed in on the charted area and, finally, not more than 100 feet from where the *Braak* was supposed to lie, the chains gripped something.

A diver was sent down and found the hull of an old vessel virtually covered with sand save for a part of the stern. Convinced that they had located the *Braak*, the syndicate began laying plans for her salvage. The *Liberty* was purchased and the assembly of supplies and equipment started. When she set out, her backers claimed that they had overlooked nothing, and that no future expedition could hope to be successful should their attempt prove a failure.

To withdraw the sand with which the *Braak* is believed to be filled, a sand-sucker was put aboard the *Liberty* in dismantled form. An unfailing supply of air for the divers is a vital requirement, and to this end her equipment includes a modern 2-stage, air-cooled Type 30 compressor driven by a gasoline engine.

The *Liberty* is commanded by Capt. Clayte Morrissey, a Gloucester skipper who sailed the *Henry Ford* in her races with the *Bluenose* for the international fisherman's championship a number of years ago. Several of the crew are sons of well-to-do Providence men who are financially interested in the venture.

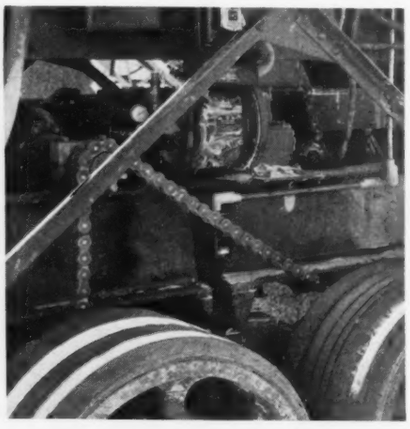
Air Motor Moves Portable Gravel Plant

IN PROVIDING aggregates for concrete, especially on big construction projects in out-of-the-way places, difficulty is sometimes experienced in locating suitable sources of supply within convenient reach. Whenever possible, the working of thin sand and gravel deposits is to be avoided; but when this cannot be done it is good practice to use a crushing and screening plant that moves up to the bank as excavating proceeds. Experience in Oklahoma, Texas, and in some other western states has proved that to be more economical than hauling the material a steadily increasing distance to the plant.

Equipment of this kind is in use; but it generally consists of available machinery rigged up for the purpose. There is an exception, however, and that is the plant designed and built by the Los Angeles, Calif., branch of the Stephens-Adamson Manufacturing Company for J. F. Shea Company, Riverside, Calif., one of the contractors now engaged in building the Metropolitan Aqueduct which will deliver water from the Colorado River to thirteen cities in Southern California, a total distance of 241 miles.

The portable plant is at work in the desert near Mecca, Calif., producing aggregates for the concrete lining of a section of that great aqueduct. The deposit from which the material is obtained is flat and from 6 to 8 feet deep. It is excavated by a 52-B Bucyrus-Erie electric shovel that has a capacity of 2¼ cubic yards and moves along with the plant, but under its own power. The bucket discharges on to a bar grizzly set over a 4½-cubic-yard hopper. The bars are spaced 8 inches apart, and any oversize passes on to and down a metal plate into a truck for removal to an Austin-Western jaw crusher having a 9x40-inch opening. The ground is always kept clear to receive the piles of finished aggregates. Undersize material goes through a feeder to a conveyor belt. 30 inches wide, that carries it to the screening plant.

The hopper is connected to the power shovel by a rigid bar that holds them the right distance apart at all times for convenient dumping. Both the hopper and the grizzly are set in a frame that rolls along on casters. One end of the conveyor mounting is also attached to this framework by means of a swiveled joint that enables the former to swing freely through an arc of 180°. The opposite or discharge end is pivoted over the feed of a 20-foot horizontal vibrating screen. Four sizes of gravel and two of sand are produced. The material from the jaw crusher is graded in the same manner but by a somewhat shorter screen.



IN ACTION

Below is shown the mobile gravel plant used by J. F. Shea Company on the Metropolitan Aqueduct to work shallow deposits. The shovel has just dumped a dipperful of raw material into the hopper, where a grizzly rejects oversize bowlders into a truck for subsequent crushing. Propulsion of the plant at the creeping speeds desired is obtained by driving a 5½-hp. air motor with oil under pressure The motor and hook-up are pictured above.

From the screens the several aggregates fall into hoppers that feed on to boom conveyors extending out from the plant in different directions. As the latter travels along, these conveyors pile the sized materials in six windrows, each grade of sand or gravel being kept in a separate windrow. This is accomplished by varying the lengths of the boom conveyors to meet requirements. From thence trucks transport the aggregates to the concrete plant on the J. F. Shea Company section of the aqueduct job. The aggregates produced require no washing; but the plant is so arranged that sprays and sand washers can be quickly and easily attached, if necessary.

When in operation, the screening plant, with the power shovel, advances so slowly that the movement is hardly perceptible, covering in the course of a day's work from 10 to 15 feet. It is driven by an Ingersoll-Rand air motor through a Mack truck rear axle and transmission. There is a two-to-one sprocket and chain reduction from the motor to the transmission and another sprocket and chain reduction from the rear-axle assembly to the rear wheels of the plant proper. The unusual feature of this driving mechanism is that it uses oil instead of compressed air, the change being made in order to obtain the positive and slow rate of speed essential to effective operation. The oil is delivered by a small motor-driven plunger pump; and about ¾ gallon is in circulation per minute. Throttling is effected by means of an adjustable by-pass. This portable and self-contained plant has a capacity of 125 cubic yards of material per hour.

THE CAPRICES OF RESEARCH

ONE of the interesting things about research is the variety and diversity of its results. Out of investigations conducted for one specific purpose may come unexpected information that opens the way to developments entirely divorced from the objective but nevertheless of value to industry and to mankind in general.

No line of endeavor is less capable of accurate forecasting than that of the laboratory worker. His efforts cannot be regimented without greatly discounting his chances for success. Hard-headed industrialists who literally stick to the rule that two and two invariably add up four sometimes fail to understand this.

At a recent gathering of research directors of large corporations it was stated and pretty well agreed that the greatest deterrent to industrial research is the vice president. He is the individual—and apparently there is at least one in almost every large concern—who insists on knowing beforehand what will be accomplished with every dollar appropriated, and who demands at stated intervals concrete evidence in the form of tangible results achieved. If a research department does not with clocklike regularity discover things that can immediately be turned into greater profits, he questions its value and wants it abolished or restricted. Such an attitude is hard to understand, for the record shows that the greatest accomplishments have come from staffs that were allowed free rein so long as they kept within their budgets.

Illustrative of the point made in the first paragraph is the recent announcement by General Electric Company of a new alloy, designated as Alnico, that is capable of retaining a greater degree of magnetism than any substance heretofore known. The surprising thing about it is that it is the outcome largely of researches conducted to find an alloy that would resist scaling and deterioration at high temperatures.

Hardened, plain carbon steel was formerly considered the best magnet material. When it was learned that iron carbide, or more particularly the manner in which iron carbide was distributed, was chiefly responsible for the magnetic properties, attention was paid to steels alloyed with elements that would form carbides. These had already been developed for the purpose previously mentioned.

Alnico is an alloy of iron, nickel, aluminum, and cobalt. A magnet made from it will lift up to 60 times its own weight. The new material is being substituted for electromagnets in various classes of machinery and apparatus, and promises to become widely useful.

WHERE STOUT HEARTS REIGN

ANYONE who has been following Mr. Rowe's series of articles on the development of Canadian mining must have had impressed upon him the fact that stern realities attend the hunt for mineral wealth. The author has drawn numerous sharp word pictures of man's struggle against nature in the raw in the great expanses of the North.

Those who lament the passing of romance and the effacing of frontiers should have a try at prospecting in Canada. For there, it would seem, the primeval is still just over the hill, and hundreds of square miles of surface are yet to be examined. Much of it is geologically favorable to the occurrence of ores.

The winning of this natural wealth is a job that calls for fortitude and hardihood. No "softies" need apply. Automobiles and airplanes have brought working areas closer; but once in the bush, a man is on his own. Heavy loads must be lugged, racing streams forded, flies and mosquitos endured. Electric lights, steam heat, dining rooms, and downy beds become dream things of another world. And yet, the men that follow this harsh life would have no other. When they "make their pile" they seldom retire to a softer existence. Fortune's caresses do not render their flesh flabby, neither do they corrode their minds nor make their hearts less stout.

It is noteworthy that the leading figures in Mr. Rowe's dramatic recital of events have gone on from one camp to another. A settled, easy life seems to pall upon their breed. A tragic note, but one that serves to emphasize this trait in their characters, is the fact that so many of them have met untimely deaths. Billy Greene of the Greene-Stabell, Stanley Siscoe of the Siscoe Mine, Bob Clark, a pioneer of Lake De Montigny, and others, might still be alive had they chosen to take their winnings and call quits on the game. Their counterparts are to be found over all the face of the earth where there is virgin ground to be searched for mineral wealth, or where there is a chance to "make a mine" from a mineralized streak. Many of them carry on because they would rather have a part in bringing ore from the ground than in counting the spoils that result therefrom.

A NEW USE OF COMPRESSED AIR

THE interesting possibility of using compressed air to move heavy objects short distances is aroused by the fact that it is actually being employed to shift a concrete roadway, as described in this issue. Apparently the method has some advantages over jacks, particularly where it is desired to keep intact the structure being moved. The automatic equalization of the pressure throughout the entire bearing surface prevents the force applied from setting up rupturing strains.

As most companies or other organizations that normally might be confronted with the necessity of shifting heavy structures have compressors, only the accessory equipment would be needed, and this is very simple and of no great cost. Manifestly, the method lends itself better to making lateral rather than vertical moves; but, with modifications of the apparatus, it might prove adaptable and serve to raise buildings and other structures of large size.

The New Jersey slab-moving job is commanding wide attention. Chance visitors to the scene are amazed to see a strip of concrete weighing 400 tons slowly edge over as though suddenly animated.

Industrial Notes

It is authoritatively stated that incandescent lamps now consume more than one-fourth of all the current generated by power plants in the United States.

Cellophane is now being used in the making of an adhesive tape that is said to adhere to any clean, dry surface without moistening.

For large industrial concerns that now include metal spraying in their up-keep and maintenance programs there is available a portable outfit complete with the exception of the air compressor.

Poretherm is something new in heat-insulating materials. Its base is ordinary portland cement and, like the latter, can be mixed, cast in forms or slabs, or be poured on the job, as required.

A by-product obtained in the refining of soy-bean oil is being used in Germany in froth flotation. The slimy residue is said to be rich in phosphatides and to possess excellent collecting properties.

Orators and spellbinders take note! Something very sonorous in loud speakers has been invented in Germany according to recent news reports. It is said to have a reach of 3½ miles and to be air operated.

Self-Contained Work Train

IN REPAIRING, guniting, and waterproofing the old Baltimore and Potomac tunnel in its recent work of electrification between New York and Washington, the Pennsylvania Railroad rigged up a 9-car, self-contained equipment train that is of interest because it did much to facilitate and to speed up operations. The tunnel is 7,500 feet long, and one of its two tracks was given over to the workmen at night.

The train was provided with a working platform from end to end and designed for multiple operation. Among the principal equipment carried were four cement guns, four compressors and air receivers, three electric generators including a 15-kw., 110-volt unit for generating current for lighting purposes, water storage tanks, and bins and other storage places for the materials required on the job. In short, it was such as to permit four guniting crews to operate at a time, and enabled them to cover from 9,000 to 12,000 square feet of surface with a coat about ¼ inch thick in a night. The walls were given three layers.

The necessity of running long air and water lines into the tunnel was thus avoided; and the trouble originally experienced with the dust- and cement-laden air was overcome by providing the air intakes of all compressors and engines with additional air filters of large capacity and with auxiliary radiators having blower-type fans.

What is a dilatometer? It is an instrument that measures and records in ten-thousandths of an inch the expansion and contraction of metals as they are heated and cooled. The device is new, and was built according to specifications of the U. S. Bureau of Standards for the use of the General Electric Company in its investigations of metals.

For users of diesel engines there has been put on the market a product, known as Lubal D, that is said to retard the formation of carbon or to soften accumulations of it so that they are carried out with the exhaust. According to directions, 1 gallon of Lubal D should be added to every 320 gallons of fuel oil for badly carbonized engines, while a proportion of 1 to 425 is recommended for clean or new engines.

The manufacturer of Self-Vulc, a rubber coating that comes in liquid or plastic form, has produced a primer to be used in connection with it that is said to add considerably to its effectiveness. The primer and the liquid rubber can be applied by brushing, dipping, pouring, or spraying, while the plastic material is put on by means of a spatula. The rubber vulcanizes when exposed to the air. It has a wide field of application.

Master Builders Company, Cleveland, Ohio, is marketing a new concrete admixture under the trade name of Pozzolith. It is a gelatinous colloid of high pozzolanic properties which, if added to any well-balanced concrete mix, will, it is claimed, permit reducing the water content by 10 per cent and more without destroying the workability of the mass, will lessen shrinkage of the concrete, increase its resistance to sodium-sulphite solutions and to freezing and thawing, and give it added compressive strength. The makers recommend that not less than 1¾ pints of Pozzolith be used for every sack of cement; and for lean mixes the permissible minimum is a gallon per cubic yard of concrete.

The Basset process for the simultaneous smelting of iron ore and the production of cement clinker is receiving its first commercial application in the Moncada cement mill of the Asland Company in Spain. For this purpose one of the three kilns in the plant, which makes use of the dry method, has been modified to meet the changed operating conditions. The raw materials—iron ore, coal, and limestone—become slightly moist at the entrance to the kiln. At a point about 10 feet in from the head is an opening through which the molten iron is discharged at each revolution of the kiln, while the cement clinker is fed continuously from the delivery end just as in the regular rotary type. The striking part of the operation is the completeness with which the two materials are separated before they leave the kiln. It is said that the cement and iron produced are of high quality—the former possessing all the desired characteristics, while the latter contains about 4 per cent carbon and traces of phosphorus, and is low in silicon and manganese.

One of the attractions at the last Leipzig Fair was a model of a 1,000-kw. wind power plant that has been erected near Berlin, Germany, for experimental purposes. Broadly, the latter consists of a 197-foot mast carrying wings which have a spread from tip to tip of 197 feet. The electrical machinery is suitably housed, and revolves around the mast according to the direction of the wind and without the aid of a weather vane. One of the outstanding features of this station is said to be a newly developed switching and storage-battery system that assures a steady annual kilowatt-hour output regardless of the velocity of the wind and one that can be adjusted to meet the varying demands of the consumers. The Teubert plant has been constructed in order to make a thorough study of the technical questions involved, and is just about half the size of those that have been designed to operate on an economical basis and that Germany proposes to provide for the convenience of small isolated communities.

Plant Uses Colloidal Fuel

PULVERIZED coal and oil, mixed in equal proportions—colloidal fuel, in other words—is being burned with success at the works of Wyndham's Marine Patents, Ltd., Cardiff, according to British news reports. A total of 100 tons of it are produced there in a 160-hour week by a process developed at the plant. Washed fine screenings are mixed with heavy oil and fed to a mill, where the mass undergoes preliminary smoothing out before being pumped to a second mill from which it issues in a condition permitting almost 100 per cent of the contained particles to pass through 60 mesh. The mixture, now fairly stable, is pumped to still another mill where the grains of coal are so reduced in size that 99 per cent of them will go through 200 mesh.

On its way to the burners the fuel is preheated to about 200°F., at which temperature it has been found to give the best results when used for steam raising. It is delivered under a pressure of from 15 to 20 pounds and with air at 2 pounds pressure. Combustion of both the coal and the oil is said to occur almost simultaneously and without the usual by-products. Under ordinary circumstances and at normal temperatures the fuel remains stable for a minimum period of four months; but when stored in sealed containers it can be kept much longer without separating.

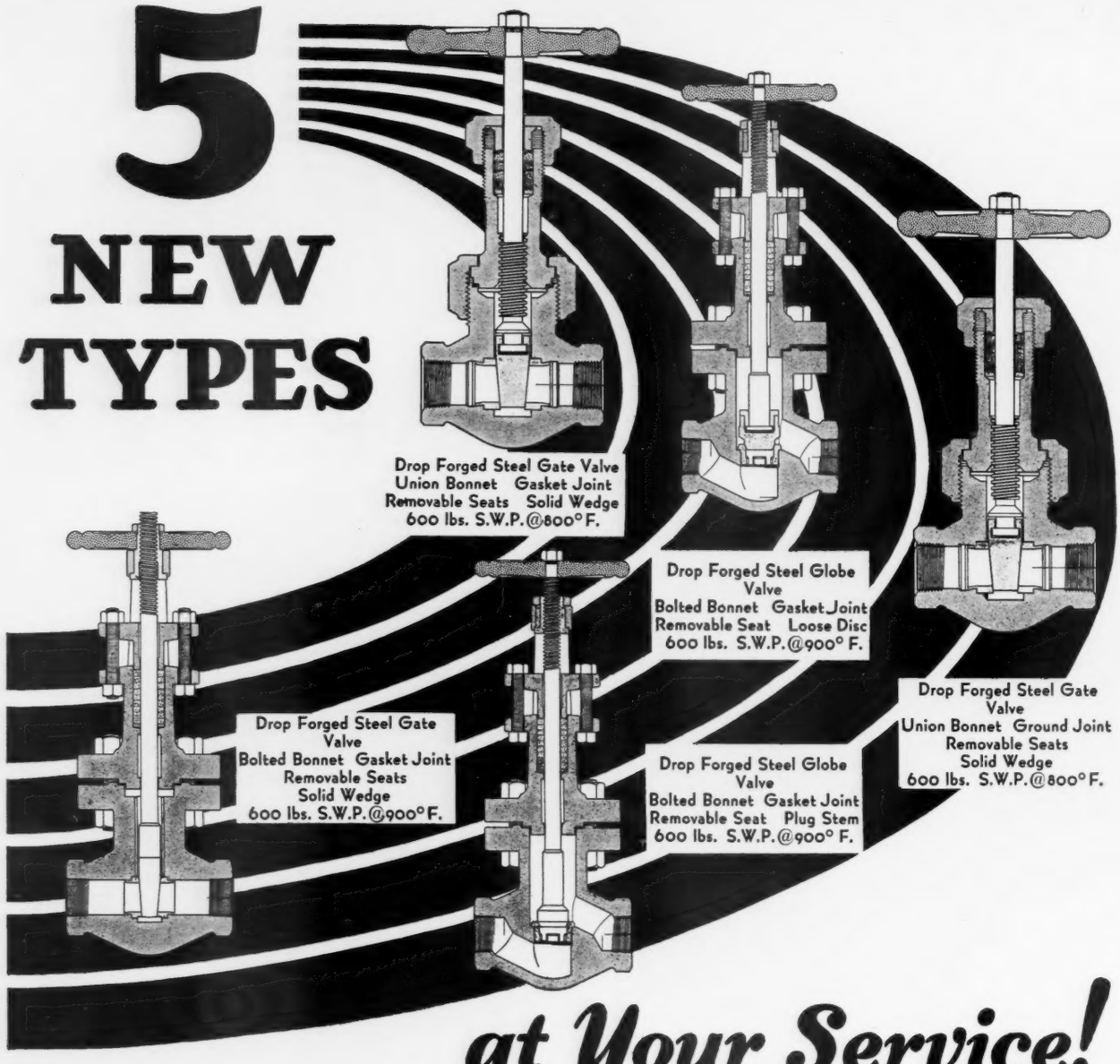
DUST CONTROL is *Dollar* CONTROL

with DUSTOP *replacement type* AIR FILTERS

● Now, Dustop replacement type air filters enable you to cut to a minimum your dollar losses caused by destructive abrasion of dust in your air handling equipment. Dustop filters for all sizes and types of compressors, gas and Diesel engines, are available in complete, inclosed units ready for installation. May we send you our catalog, "Application of Dustop to internal combustion engines and air compressors"? Distributors, carrying complete stocks of Dustop replacement filters, located in all principal cities. (Dustop is distributed in Canada by General Steel Wares, Ltd., Toronto.) For details write to Owens-Illinois Glass Company, Industrial Materials Division . . . Newark, Ohio.

OWENS-ILLINOIS **DUSTOP** **AIR FILTERS**

5 NEW TYPES



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They will give long uninterrupted service with absolute safety under the most trying conditions. Positive control and quick release are characteristic of Vogt valves. Strength and endurance, that drop forging *alone* can give, are developed to the highest degree.

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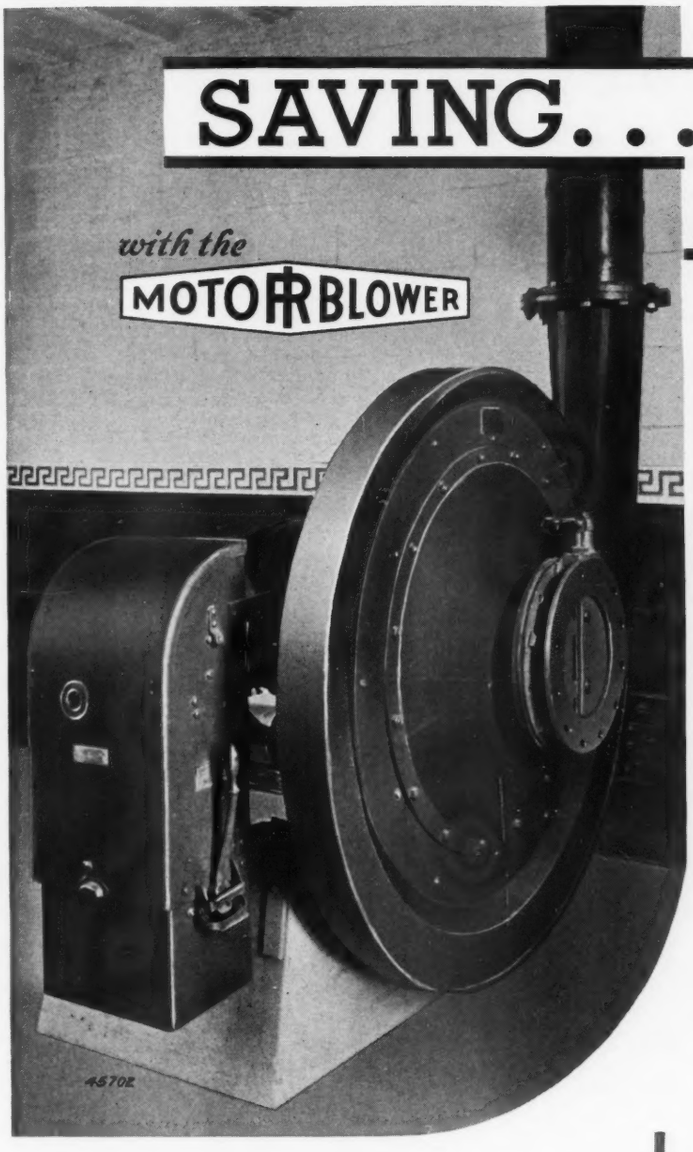

SAVING... 403 KW. *hours per day!*

These savings on power alone are obtained by the installation of a Motorblower in an asphalt still. Other economies, including a substantial cut in blowing time, increase the total saving of the new installation.

Your own low-pressure air costs may be materially reduced by using Motorblowers. Many new and unusual applications for air supplied by these modern centrifugal machines have been developed through close cooperation with Ingersoll-Rand engineers.

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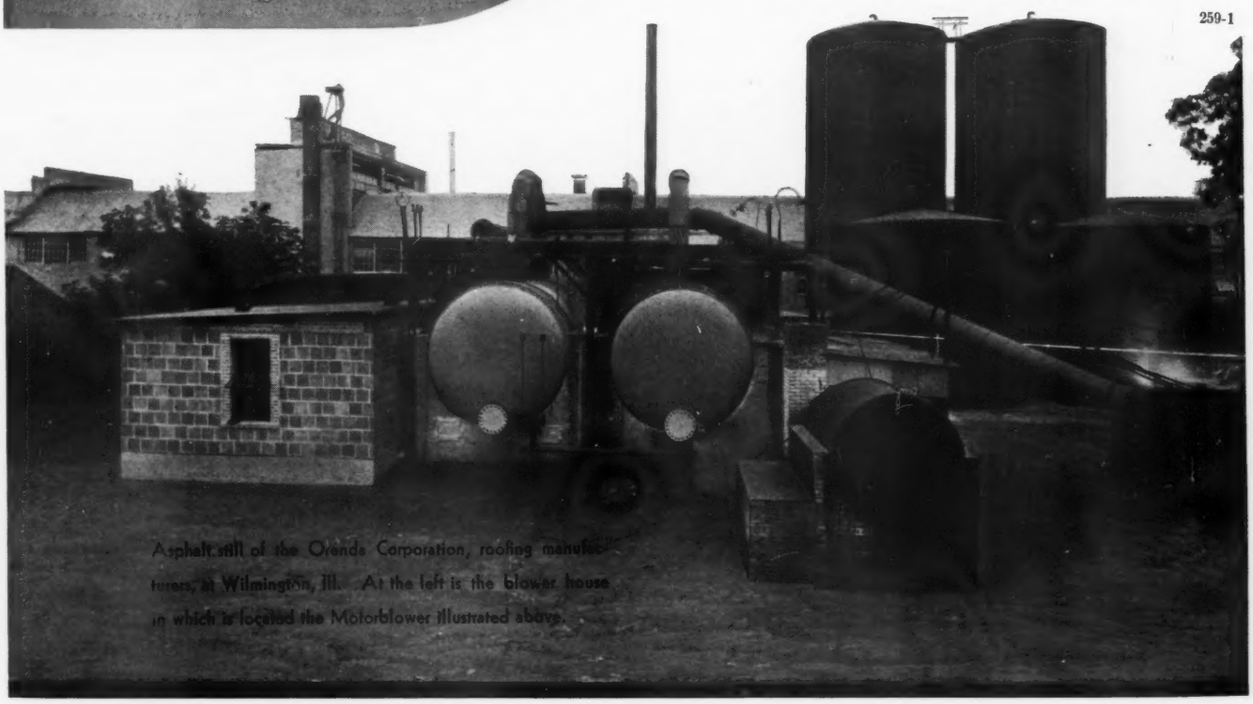


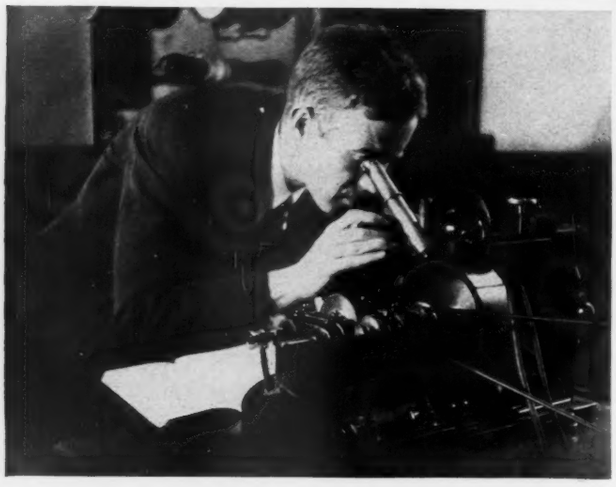
Asphalt still of the Orenda Corporation, roofing manufacturers, at Wilmington, Ill. At the left is the blower house in which is located the Motorblower illustrated above.

Blasting NEWS

PREPARED BY

HERCULES POWDER COMPANY
INCORPORATED

WILMINGTON, DELAWARE



TEST IS ACCURATE TO 1/1,000,000 SECOND

A machine that measures accurately to 1/1,000,000 of a second is described in the new Hercules booklet "Making Better Explosives." The instrument is called the Mettegang Recorder; it is used to check the velocity of Cordeau-Bickford detonating fuse, which in turn is used in checking the velocity of dynamite.

"Making Better Explosives" is designed to point out the great care exercised in the manufacture and testing of Hercules explosives and blasting supplies. It emphasizes that high quality and strict uniformity come from research, manufacturing skill, and thorough testing.

Some of the apparatus and tests mentioned in the text, besides the Mettegang Recorder, include: the Bichel gauge, ballistic mortar, hardness and plasticity gauges, underground gas chamber, testing pit, electric blasting cap test, and moisture control apparatus.

The booklet is attractively printed, with modern spiral binding, and is available to those who are interested primarily in explosives quality.

HERCULES
PLANNED BLASTING
makes available:

1. Explosives exactly suited to your work.
2. Organized methods enabling you to use them to best advantage.

WRITE FOR DETAILS

HOW HERCOMITES WERE DEVELOPED

The Hercomites were the first high-count ammonia dynamite for industrial use, it is pointed out in "Little Stories of Explosives Research," the first of a new series of miniature booklets just printed by Hercules Powder Company.

For years, explosives consumers had been looking for more economical powders that would be as satisfactory to use

as other more expensive grades. Hercules research solved the problem with Hercomites and thus made possible great savings to many explosives users.

The Hercomites, according to the booklet, represent but one of a number of important contributions made to blasting by Hercules. The story of some of these developments will be described in the remainder of the series of little booklets, to be issued subsequently.

Copies of "Little Stories of Explosives Research—the Hercomites" will be sent free on request.

DRIVING WORLD'S TUNNEL RECORD

Drilling an average of 26 holes to the round and using Hercules 40% gelatin dynamite, three crews, working 8 hours each, made what is believed to be a world's record in driving a 9-ft. tunnel when they advanced 65 ft. in 24 hours, according to information published in the June, 1935, issue of THE EXPLOSIVES ENGINEER.

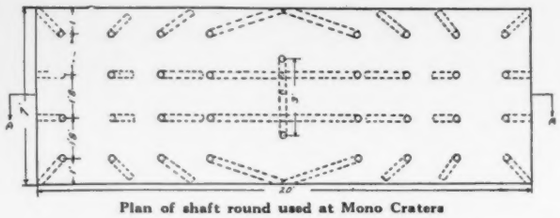
The world's record is one feature of the article entitled "Mono Craters Tunnel," descriptive of the methods used at the great water diversion project, at Mono Lake, north of Los Angeles, California.

Not only is the Mono Craters tunnel noted for this world's record, but the engineering procedure is intensely interesting to contractors. For example, the switching method and equipment speeded mucking operations 20%.

The $9,000,000 project commands much attention along the Pacific Coast because it represents a water diversion program 300 miles from Los Angeles. With the added supply of potable water, Los Angeles is preparing to meet the future challenge of population growth.

Details of the project are fully explained in the article. This is but one of several important articles on tunnel methods recently published in THE EXPLOSIVES ENGINEER. Other tunnel projects completely covered in THE EXPLOSIVES ENGINEER, especially in regard to drilling and blasting methods, include the Colorado Aqueduct series of tunnels (May, 1935), and the Twin Lakes tunnel, driven under Independence Pass, near Aspen, Colorado (December, 1934, and March, 1935).

Copies of these various issues will be sent on request.



Plan of shaft round used at Mono Craters

37 PERMISSIBLES REDUCED TO 10

How 37 permissible explosives marketed by Hercules in 1922 have been supplanted by a list of only 10 modern permissibles, which cover an even greater range more completely and effectively than the 37 replaced, is an interesting statement contained in the booklet "Hercules Permissibles."

The booklet is designed to help the industry in the selection of permissibles for the various mining conditions encountered. By discussing the characteristics of various Hercules permissibles, together with physical data on each explosive, it is possible for the user to understand the types of permissibles recommended for coarse coal, lump coal, rock work, and wet work.

By means of a relatively small permissible list Hercules not only makes selection less difficult, but, by concentrating on relatively few grades, is able to make better and more uniform products.

Copies are available on request.

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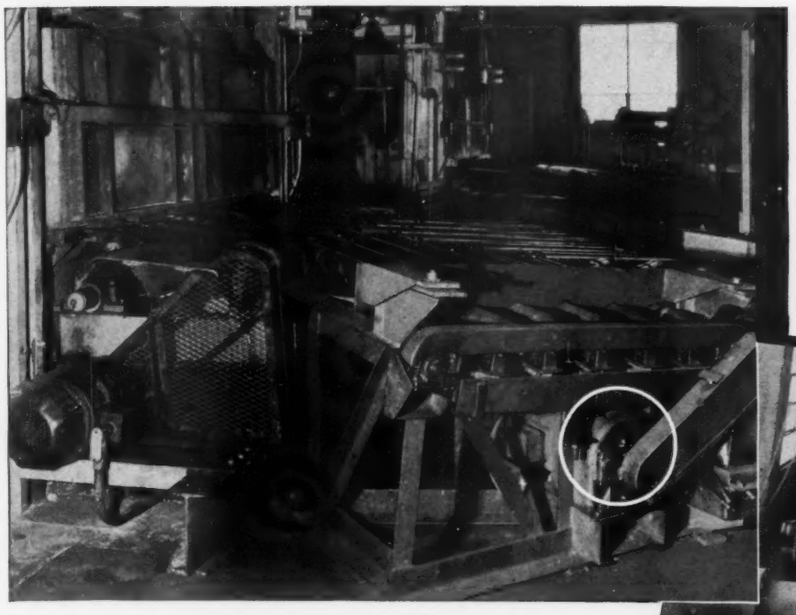
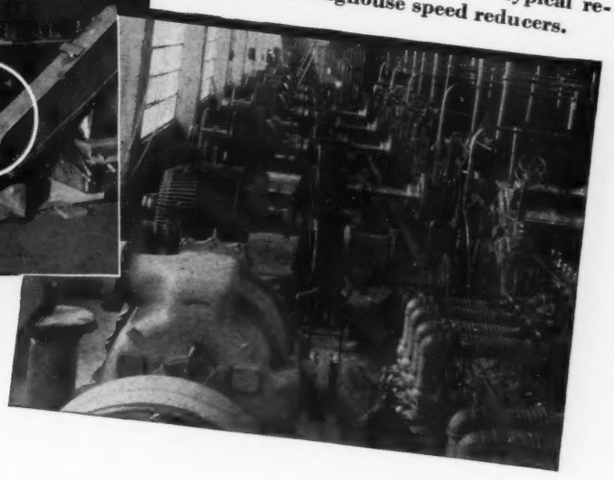


On this sheet catcher the gearmotor (shown in circle) simplified installation and saved valuable aisle space. A totally-enclosed fan-cooled motor excludes dust and abrasives.



Almost 12 years' paper mill service with no attention except oiling—a typical record of Westinghouse speed reducers.

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whichever best fits **YOUR** *application*

The lighter weight, smaller size and lower first cost of gearmotors make them the preferred method of powering most slow-speed applications. But if in your modernization program you can reemploy efficient motors now in service, the speed reducer may prove less expensive and equally satisfactory.

Westinghouse standard equipment is available to meet practically every requirement. Designed by specialists, manufactured by specialists, tested by specialists . . . in one of the country's oldest, largest and best equipped gear plants . . . Westinghouse power transmission equipment meets the most exacting standards.

Features such as BPT single helical "tough-hard" gears, sturdy anti-friction bearings, and accessible case construction, result in equipment that can successfully withstand the smashing impact of steel-mill rolls, the steady, relentless grind of paper mill machines, and abrasive dust in cement mills and quarries.

For information regarding savings that resulted from replacement of obsolete transmission equipment with gearmotors, and the savings and applications for this type of drive ask for Booklet 2049. For similar information on Speed Reducers, request Booklet 2040.

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On Production Assembly Work

INGERSOLL-RAND POTT IMPACT WRENCH

Every mechanical operation in production manufacture has been speeded up—only assembly has often lagged behind.

Now with the new Ingersoll-Rand Pott Impact Wrench many assembly operations get in step with the production program.

This new Pneumatic Wrench seats and tightens bolts, nuts and screws faster and the work is more certain, more uniform. It handles harder, heavier work than other pneumatic devices, yet weighs about half as much, uses about half as much air.

It removes frozen nuts—there is no hammering to loosen. It is built on safety-first principles—no danger of injury to the operator.

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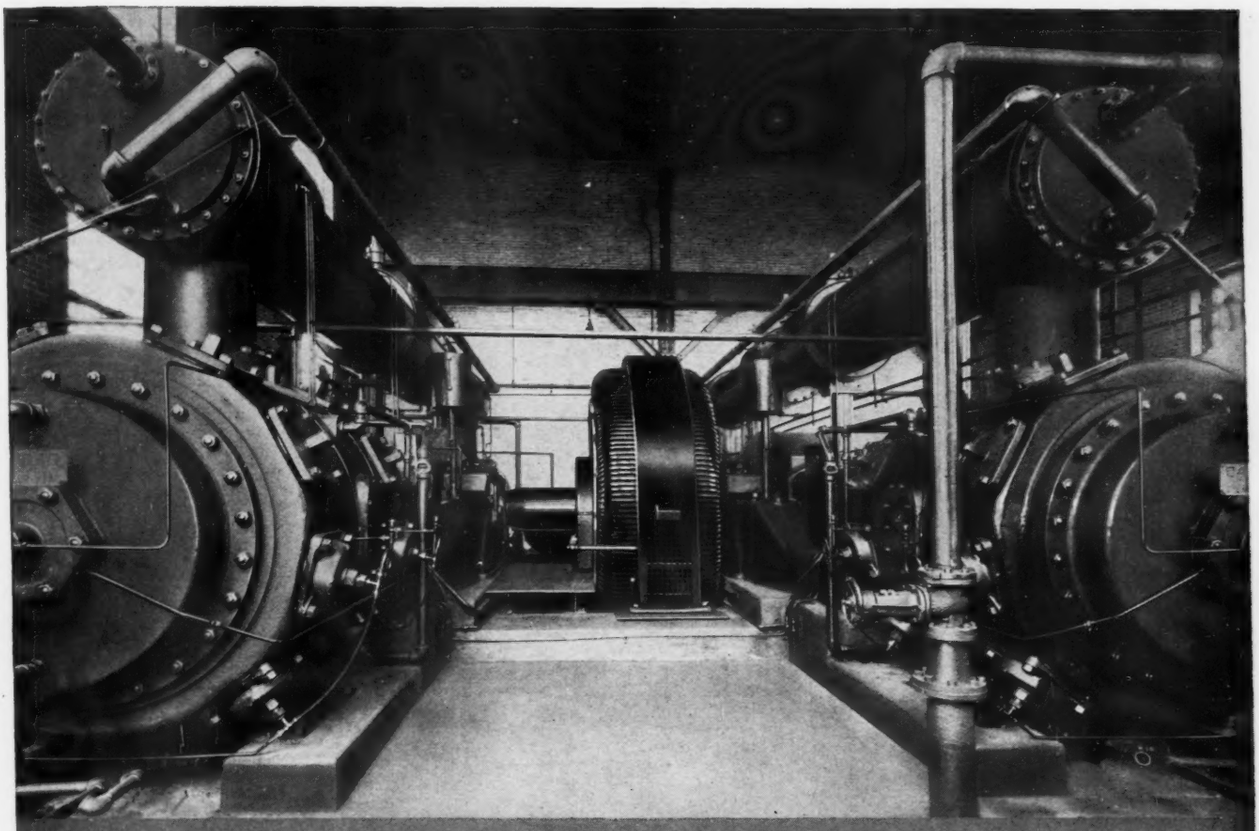


How You Save

when a G-E Synchronous Motor drives Your Air Compressor

BY CONTINUITY of service and economy of operation, this giant 3000-horsepower G-E synchronous motor, which drives the reciprocating compressor in a large eastern steel plant, has been saving money ever since its installation, more than four years ago.

Part-winding starting, a feature that means easy starting, keeps the kv-a. demand low, and cuts power costs, was adopted in designing this motor — the largest part-winding-starting synchronous motor in the world — because of the limitations on current inrush in the plant where it is installed.

Whatever you require in drives for large compressors, you will find G-E synchronous motors ideally suited to your purpose. G-E engineers, working in close co-operation with leading compressor manufacturers, have designed synchronous motors that are electrically correct and mechanically strong — motors that are literally tailored to your compressors — motors that will pay you substantial dividends in economical operation, freedom from maintenance, and long life.

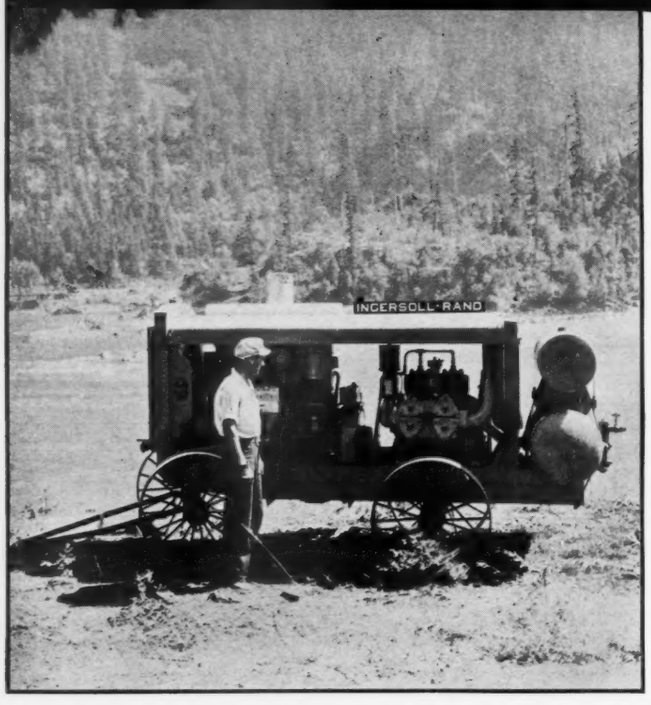
Specify G-E synchronous motors and controllers for your compressors. The day they're installed, your savings will begin. For complete information, consult the nearest G-E office, or write General Electric, Dept. 6B-201, Schenectady, N. Y.

040-13

GENERAL ELECTRIC

● *Ingersoll-Rand Portable Compressor, powered by 110 hp. Waukesha Hy-Powr Gasoline Engine, on barge moored in river channel, outside coffer dam, used by Columbia Construction Co.*

WAUKESHA ENGINES ON THE JOB AT THE BONNEVILLE DAM



● *Excavating for lock and powerhouse area in Bradford Slough. Ingersoll-Rand Portable Compressor, powered by 100 hp. Waukesha-Hesselman Engine.*

●

WAUKESHA ENGINES

● Not only on the Bonneville Dam job, in air compressors—but in thousands of jobs, for every industrial use, Waukesha-Hesselman Oil Engines and Waukesha Hy-Powr Gasoline Engines are establishing in all parts of the world impressive records for long-time, day-in-day-out operation at remarkably low up-keep costs.

About the same size and weight as a gasoline engine, the Hesselman Oil Engine starts as easily, runs as smoothly, develops equal or greater power, and is moderate in first cost. Burning the modern high speed Diesel fuels, *its fuel cost is extremely low*, and it is so simple in construction that anyone understanding gasoline engines can operate it.

Waukesha-Hesselman Engines . . . for industrial tractors, road building, logging, oil field, and contractors' machinery, electric lighting and power plants, as well as trucks and marine propulsion . . . are made in a wide range of sizes from 20 hp. to 300 hp., both four and six cylinders.

Write for Bulletin 1000. Waukesha Motor Company, Waukesha, Wisconsin.

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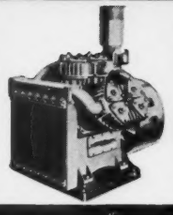
Move in the right direction Follow the IR Line for the Mine

"Pickhamer"—light weight, powerful, easily handled air tools for general utility work.

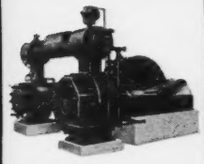
Wood Borers—for all classes and types of woodboring work up to 4" diameter.

"Safety-First" Air Saws—for trimming and cutting all materials to 4½" depths.

Mine Car Compressors—exceptionally low head room with sufficient track clearance.



"Motorcompressor"—two-stage, air-cooled with "built-in" motor. No freezing hazard.

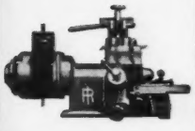


Stationary Air Compressors—sizes, types and styles of drive for all service conditions.

"Jackhamer" Drills—complete range of sizes—a drill for every job—dry, wet, and auger types.

"Jackbits" and Drill Rods—large variety of shapes and sizes for all conditions.

"Jackbit" Grinder—for regrinding bits to gauge and resharpening cutting edge of "Jackbits".

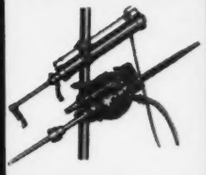


Paving Breakers—for taking up bottom, grading roadbeds, slabbing, digging drainage ditches.

"Stopehamer" Drills—air feed drills for uphole work, hand and automatically rotated types.

Auto-Feed Drifters—feeding is completely automatic. Can be operated in close quarters.

Explorer Diamond Drill—for locating or following veins ahead of winzes, stopes, etc.



Sharpeners—for making all types of bits and shanks on steel, coal cutter bits, picks, etc.

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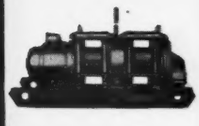

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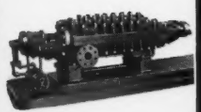

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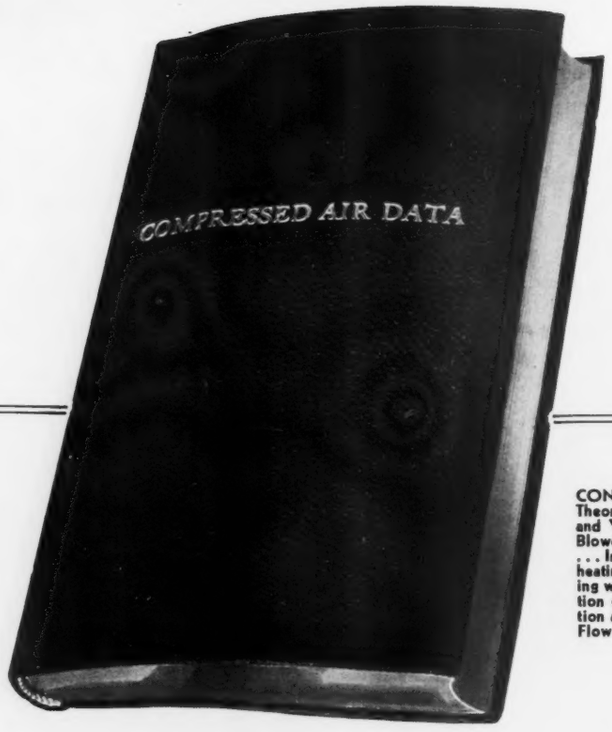

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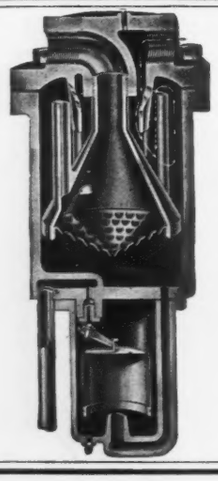

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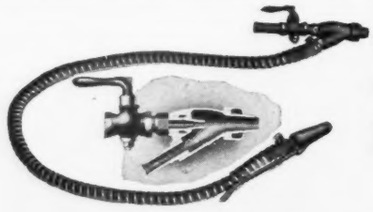

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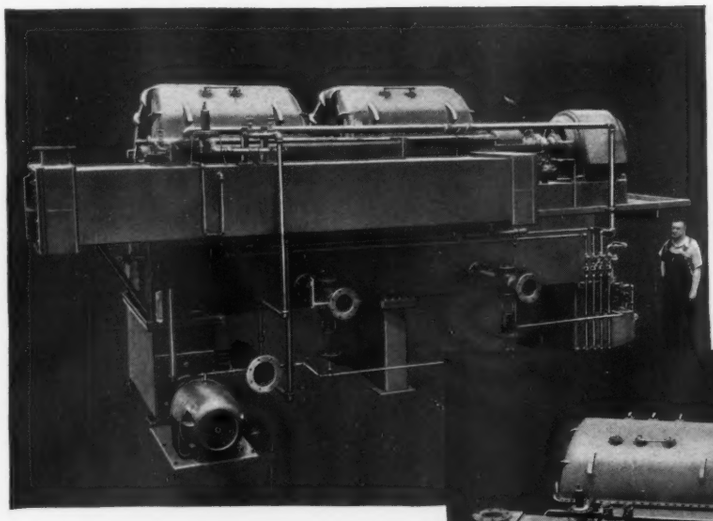
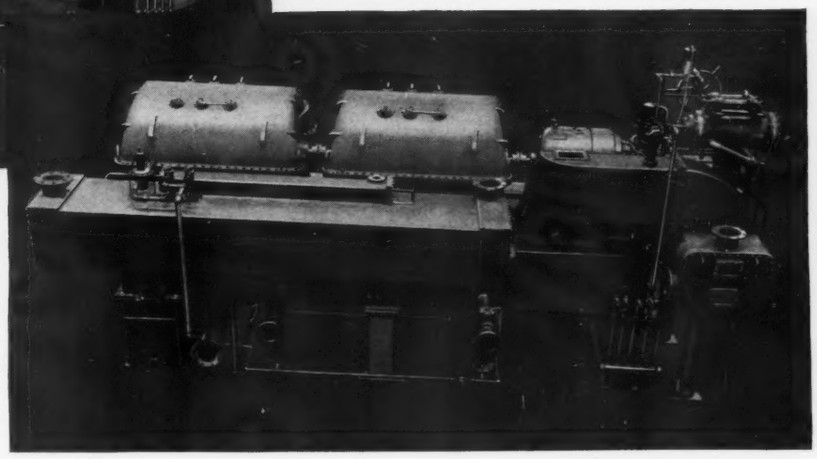


The Ford Motor Company at the Rouge plant, Dearborn, uses five I-R Centrifugal Water-Vapor Refrigerating Units totaling 1310 tons refrigeration. These pictures, taken before shipment from the I-R factory, show two of the twin-compressor units, one motor-driven and one turbine-driven. These two, with an exact duplicate of each, served the 1935 season. The first of the five units was a motor-driven, single unit installed in 1934.



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Most interesting is the installation of the two units supplying chilled water for air conditioning the foundry moulding rooms in the special metal casting department, and also in the drafting room and trade school.

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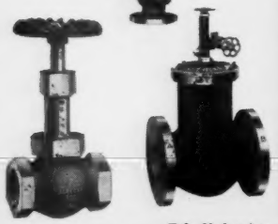

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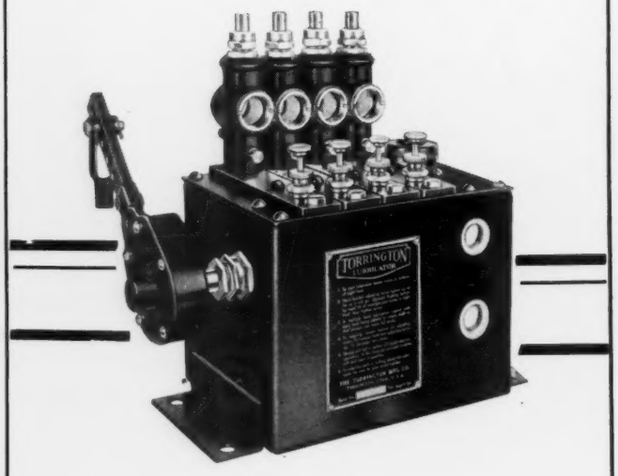

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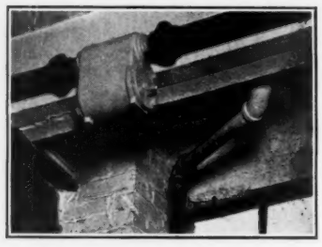
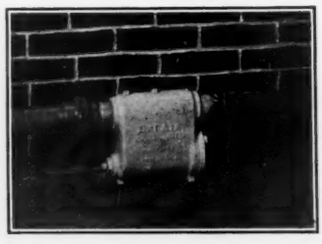


The DriAir Separator separates and automatically ejects the condensed water from compressed air lines; collects rust, pipe scale, sediment and dirt from the pipes; delivers clean, dry air to tools and other pneumatic equipment. This promotes better and more uniform lubrication and prevents rapid wear, freezing and rusting of tools. The increase in production and the saving in tool depreciation quickly pay for the cost of installing the DriAir.

DriAir hangs from the piping above or stands on the floor below. Being a separator and trap combined into a single unit, it requires no attachments, pipes straight through and when once installed requires no further attention.



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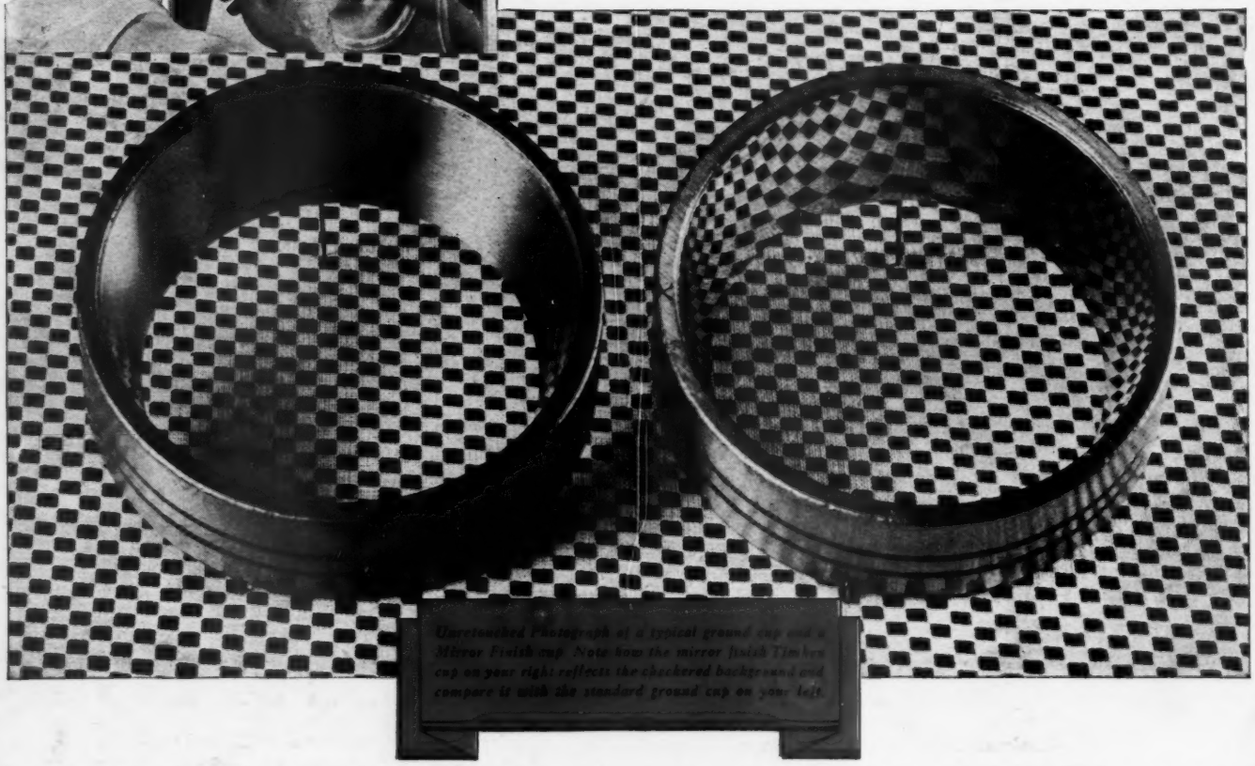

Unretouched Photograph of a typical ground cup and a Mirror Finish cup. Note how the mirror finish Timken cup on your right reflects the checkered background and compare it with the standard ground cup on your left.

"MIRROR FINISH", the amazing new finish developed by Timken for the contact surfaces of Timken Bearings, is all that the name implies. It is by all odds the finest finish ever applied to anti-friction bearings commercially.

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